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NEW YORK, SATURDAY, AUGUST 12, 1899.

CONTENTS.

	PAGE.
Editorial	221
Revision of Patent Classification	224
Naval Tests of Marconi Wireless Telegraphy	224
An Important Street Railway Move in Atlanta, Ga.	224
Automobile Truck Competition in England	224
Underground Wires in Boston	224
Canadian Power Plants, VII.—Plant for Electric Power Service, Peterboro, Ont., by E. M. Archibald	225
Concentric Wiring, by Mervyn O'Gorman	228
The Energy of Carbon, I.—by C. J. Reed	231
An Electric Pantagraph, by Lieut. F. Jarvis Patten	233
Electric Railway Welding at Buffalo	234
Electric Asepsis	235
Electrical Measuring Instruments	236
Electrical Standardization, VI	236
Current News and Notes	237
LETTERS TO THE EDITORS:	
Lodge Wave Telegraphy, by Reginald A. Fessenden	239
Illumination of Tower Clocks, by Edward Rowe	240
Coherer Action, by Alfred G. Dell and S. Z. Flint	240
Oxidation of Carbon at Ordinary Temperatures, by C. J. Reed	240
Digest of Current Electrical Literature, compiled by Carl Hering	241
New Books	245
A Portable Testing Telephone Outfit	245
Delivery Wagon for the U. S. Express Company	246
Searchlight Projectors	246
The North Multiple Telephone Switchboard	247
The Spencer Telephone Transmitter	248
Harvard Lightning Arresters and Fusible Cut-outs	248
The Woodward Water-Wheel Governor	248
An Hydraulic Engine	249
An Adjustable Type of Steel Pressure Blower with Enclosed Motor	250
Prentiss Electric Time System	250
NEWS OF THE WEEK	251

A COMPENSATION.

As in the unfortunate strike in Cleveland, so in New York and Brooklyn, the later conditions of street railway operation make to the advantage of the management. If there are 500 cars laid off, under the old regime, it would have meant 5000 or 6000 horses eating their heads off unremuneratively in idleness, with the need of attendance and the risk of suffering for want of it. In the electric system, the contraction of expense is automatic and narrows down closely to the loss of interest on the investment. Hence, while a modern management does all that it can to avoid a strike, there is not the old dread of its fearful losses. The same feature of saving comes in with regard to automobile work, for obviously the vehicle can stand still indefinitely without recuperative oats and hay every few hours.

REGULATION OF ALTERNATING CURRENT MACHINES.

In another column we print a brief abstract of a patent just issued to MM. Hutin and Leblanc on a method of excitation for alternating current machines, by means of which it is claimed that the voltage of all types of alternating current generators may be very accurately regulated, and the power factor of motors retained at unity. Moreover, by eliminating the disturbing effect of armature reaction such machines may be designed to give a maximum output for a given weight of copper and iron. The method consists in employing for the exciter, what in principle is a complicated form of rotary converter. The exciter has in effect two armatures, and in the case of a generator excitation, the winding of one is in shunt with the generator and that of the other in series with the armature of the same. These two windings are enveloped by a third winding connected with a commutator, from which, as in the case of the rotary converter, direct current is taken when the exciter is run at a speed synchronous with that of the generator. The armatures of the exciter are within a stationary iron casing supplying a field circuit, which field has, however, a larger gap in the portion belonging to the armature with the shunt winding, the design being such that the shunt flux shall be constant while the series flux shall vary with the amount of current flowing in the main circuit. This results in the production of an exciting current varying with the generator current, as in the case of direct-current compounding. The windings may also be so proportioned as to provide for overcompounding, and, it is claimed, to maintain practically a zero difference of phase between the current and armature electromotive force. With the usual thoroughness of these inventors, the principle is presented under modifications making it applicable to single-phase and polyphase machines, and to synchronous and asynchronous motors.

TROLLEY ACCIDENTS.

The plunge of a trolley car from a trestle near Bridgeport, Conn., resulted on Aug. 7 in the killing of 29 people and the injuring of a dozen more. Such an accident as this not only excites public feeling and indignation but leads to an inquiry whether any part of the electrical system was to blame. So far as can be ascertained, everything electrical was all right; in fact the position of the controller

lever is said to show that at the time of the accident the current was completely cut off. This would be natural and proper. Moreover the brakes appear to have been set. Apparently the car traveled down the approach to the trestle at a high rate of speed and was swaying considerably when the trestle or bridge was reached. The bridge remains in good condition, but appears to be without guard rails of any kind. The facts seem to warrant the conclusion that the motorman let the car get too great a headway and that after the car got away from him and jumped the track, there was nothing to prevent it from falling into the muddy pond far beneath and there "turning turtle" over the unfortunate passengers.

An accident of this character must be thoroughly investigated and doubtless will be, but one can hardly resist the conviction that it belongs in the preventible class. It is claimed that the motorman in his confusion threw the current on instead of off, and hence rendered the accident inevitable. Be that as it may, there are places where it is necessary to reinforce and multiply the precautions against accident, and this would certainly appear to have been one of them. Such a trolley car, with its short wheel base properly handled, ought to be able to make the run over a substantial trestle like that at Shelton without the slightest trouble. If there is any new reason to show why it cannot make the trip safely any number of times, it is sincerely to be hoped that a searching investigation will bring out the facts and lead to the needed improvements in methods or mechanism.

ANOTHER MENACE TO ELECTRICITY.

A financial newspaper prints what it considers "probably the most important announcement made in financial circles in recent years, not only for the financial community but for the public at large." This announcement is that the Boston & Maine Railroad has adopted coke as fuel for its engines, and that some of the largest railroads in New England have been asking the price of coke, which leads our contemporary to conclude that a solution has been obtained for "the transportation problem in which the public as well as financial interests have been much interested for some years past. Locomotive coke and oil road beds have settled the problem of railway competition with steam apparatus"! We are not aware what percentage the fuel used by steam roads enters into the cost of transportation, but it probably does not exceed that of electric railways where this factor is from 4 to 10 per cent. of the total cost, and therefore a lesser cost of coke for fuel would cut but a small figure. The article in question lays must stress upon the elimination of sparks and dust resulting from use of coke, the implication being that the electric railway owes its popularity alone to the absence of this nuisance.

The facts of the case appear to be that, pressed by the competition of the electric light, the Boston gas interest, in the hope of reducing the cost of its product, adopted the Hoffmann process of gas manufacture, which has met with favor in Europe. While this process undoubtedly reduces the cost of working on the basis per ton of coal used, the amount of gas produced from a ton of coal is less than one-half that obtained by the usual processes of gas manufacture, while the amount of coke residuum is three times greater. In other words, the process is one rather for the production of coke than gas, and the quality of coke is such as not to admit of its being used in iron manufacture. As in the present instance there was no existing market for the coke, the gas interests apparently have used their powerful influence to foist it on the roads, and then in print make a virtue of the necessity, at the same time transferring the assumed menace from the electric light to the electric railway.

COINING NEW WORDS.

Although the automobile art is a good many years old and has been a popular amusement and a steady business in France for a long time past, it is only now that some people are waking up to the fact and are proposing to find names and a phraseology for the newcomer among the arts. Such enthusiasm is better late than never, but it is likely to result in trouble and in the choice of names and terms for which the public, that great jury giving the final verdict, has no use and which it will but condemn if it indeed has not done so already. For example, one of our most highly esteemed contemporaries has just come out with a declaration that it takes the term "motor-vehicle" as its standard for designating this new class of vehicles, and it thinks that index and library authorities will make no mistake in following its example and in accepting the term. Another good contemporary has picked out "electromobile" as a winner and has "put its money" on that steed by awarding a prize to the author, if such he may be called.

All this is very laudable, but it seems open to some objections. "Motor-vehicle" is most decidedly wrong. A trolley car or a steam locomotive is a motor vehicle, but both are something which an automobile is not. Neither is, in any such sense as is intended, "mobile," but is restricted to tracks, and it is just there that the excellence of "automobile," the word chosen by the French Academy, comes in, a word, by the way, in universal use already. "Electromobile" again is a word with limitations and does not suggest a vehicle on solid earth at all. It might just as well be an electric boat or an electric balloon or an electric motor driving an elevator.

We have not ventured to offer any word of our own, but have accepted "automobile" as being good enough. We are not sure it will stick, but it seems likely to do so. We have heard a number of people lately speak of "autos" and some of "electros," and there is no sufficient reason why the public should not settle down to these just as it has to "bus" and "phone." Everybody in England says "bus," and we are very sorry to note that a great host of newspapers in this country say "phone." On the other hand, words selected for general consumption do not always win popular approval. President Rossiter, of the Brooklyn Rapid Transit system, has just incorporated the word "motorneer" into his official vocabulary. But why will not "motorman" do? He is still in his electrical novitiate and probably does not know that "motorneer" was given a thorough trial at least ten years ago, when it soon lapsed into the deserved oblivion from which he has now dragged it. So with other words. Mr. Woods suggested "autobaine" the other day for the automobile, but it is difficult to believe that the public at this late day will swallow that sweet morsel, or extend the word into "autobaineer" and "autobaineeress." A few suggestions were presented in our columns recently as to new units, but we deem this a work in which the public is willing to be led, although even yet the popular adoption of the volt and ampere cannot be regarded as overwhelming.

HIGH-PRESSURE VERSUS LOW-PRESSURE ALTERNATORS.

In these days of high-pressure electric transmission, it is often a question as to whether the generator should be constructed so as to deliver high-pressure directly to the line, or as to whether a low pressure generator should be employed with step-up transformers. Much, of course, will depend upon the local circumstances of each case, and in particular upon the voltage which it is decided to employ on the line. But many cases exist in which the radius of transmission is less than twenty miles, and in which a pressure of, say 10,000 volts, could be obtained either at the generator terminals or at the terminals of step-up transformers. It goes without saying

that a high-pressure generator should not require its armature to be rotated. In other words, it should be either of the inductor type, or of the revolving field type.

The question then to be considered is whether it is more economical to use large conductors and less insulation on the generator coils, in order to increase its output and diminish its cost, employing step-up transformers; or whether the saving effected by dispensing with the transformers at the generating end may not be availed of, without incurring too much expense in the generator, owing to the greater insulation required. Other things being equal, there can be no doubt that great advantage is obtained by dispensing with the transformers. Transformers cost money to purchase, they require a certain small amount of attention, and they waste a definite amount of power continuously in hysteresis, besides occupying useful space. Moreover, a transformer never improves the pressure regulation of a system, but always tends to make it worse. There is apparently not a single virtue which a transformer possesses except that of changing the pressure. It seems quite reasonable to expect, therefore, that as improvements continue to be effected in the construction of generating apparatus, that the pressures for which they can be commercially built without undue expense will continue to increase, so that the step-up transformer will become a less frequent servant than at the present time.

As regards safety in operation, there is very little to be said on either side of the question. A well-constructed alternator of the revolving field type can have a very high pressure in its armature and yet not be liable to cause injury to the men controlling it. The armature coils can be thoroughly protected and the main terminals of the machine can be entirely enclosed. It is only a few years ago since the pressure of 1000 volts alternating was considered the maximum which it was safe to deliver from an alternator armature, and now 12,000 volts are sometimes delivered, while probably the end is not yet in sight. Moreover, it is much more important to have the secondary circuits of the step-down transformers thoroughly protected and beyond all suspicion of danger, than to have great care exercised with the generator apparatus; because the secondary circuits are exposed to the contact of all classes of people, the great majority of whom are ignorant of the danger incurred, by a cross, whereas, the high-pressure generating apparatus is situated in a station under the supervision of a few men who are supposed to be familiar with the danger and the means of avoiding it.

ON THE TEMPERATURE ELEVATION OF DYNAMO-ELECTRIC MACHINERY.

The recently published report of the Standardization Committee of the American Institute of Electrical Engineers,* contains recommendations for measuring the temperature elevation of electric machines, that are of considerable importance to the electrical fraternity. All electric circuits of these machines are measured for their temperature elevation by electric methods, the resistance of the circuit being first measured with the machine at normal temperature, and is again measured when the machine has attained its temperature elevation under load.

The method is very readily carried out in the case of high-pressure apparatus, in which the resistances to be measured are relatively large, but special precautions have to be taken with low-pressure apparatus, owing to the very small resistances which these apparatus necessarily possess. All that is necessary is to send a continuous current through the circuit and measure the difference of potential between the terminals. With high-pressure apparatus, the current may be feeble and the potential difference comparatively large, while with low-pressure apparatus the current will be relatively large and the potential difference will be measured, say in millivolts. Moreover, it is a fortunate circumstance that provided the voltmeter employed has a scale whose readings are reliable, so far as their relative indications are concerned, the absolute accuracy of the voltmeter and of the ammeter is of no consequence. In other words all that is required is an ammeter which will indicate correctly the same strength of current before heating as after heating, and a voltmeter which will give the ratio of the potential difference accurately in the two cases. From the ratio, the temperature elevation is directly computed.

The method has the disadvantage that 1 per cent. error in the observed potential ratio will mean an error of 2.5° C. and that, consequently, considerable care is necessary in making the measurements. On the other hand, these measurements, when made with care and skill, are capable of considerable precision, and are under such circumstances quite definite. When thermometers are used, no two independent observers using different instruments are likely to agree within one or two degrees Centigrade as to the temperature elevation, whereas, two skilled observers can measure the resistance ratio within a much closer degree of concordance. There is hardly any behavior of electrical machinery that is more important than its temperature elevation. Upon this depends the safety of a machine, and by this the output and rating of a machine is established. Consequently, it is very important to avoid disputes which are likely to occur at the time of testing, when the method of observation is susceptible of different results.

Another advantage of the electrical method is that it can be applied immediately the load is taken off the apparatus; as, for example, in the case of an alternator, without the necessity of waiting until an applied thermometer can be brought up to maximum indication. Moreover, a number of successive observations with different current strengths can be taken and the mean result accepted, so that the measurement does not necessarily depend upon any single observation. Owing to the fact that the electric method averages the temperature elevation between the limits of the hottest portions of the circuit in deep-seated positions and the coolest portions of the circuit near the surface, it is likely to give an appreciably higher temperature elevation than can be expected from a thermometer laid upon the external surface. In fact, in the case of dynamos, a temperature elevation of 50° C. by resistance measurement, corresponds, very frequently, to a temperature of 40° C. by thermometer observation.

The general result of the electric method of measurement appears to be a distinct gain in precision. In fact, as a broad principle, electric methods are capable of a much higher degree of accuracy in skilled hands than ordinary thermal or mechanical methods. It is similar to the case of the wattmeter being more convenient and reliable than the steam-engine indicator. Since, however, the electric method of measuring temperature elevation can only give an average result lying between the maximum and minimum temperatures of the conductor tested, it is possible that where a considerable range of temperature exists, the highest temperature may be considerably greater than the mean temperature so obtained. For example, in the case of a large and deep field-magnet coil, it is possible that the highest temperature inside the coil may be considerably greater than the mean temperature indicated electrically. Under such conditions, the report very properly recommends checking the result with a thermometer and when the thermometer indicates a higher temperature elevation than the resistance, the thermometer reading should be accepted.

*See page 123 of our issue for July 22.

Revision of Patent Classification.

Owing to the many anomalies that had sprung up in the grouping and classification of patents, due to the growth and overlapping of inventions, steps have been taken to remodel the work, and last year Congress enacted a law "for revising and perfecting the classification of letters patent and printed publications in the Patent Office." A new division, to undertake the work of reclassification, was created in the fall, and Examiner Skinner was put in charge of it. As a preliminary step it was considered desirable to ascertain how much of the material in the office was available, and to that end it was decided to rearrange the original drawings of all patents in numerical order, and to prepare a list on which they could be checked. These drawings had formerly been arranged by subclasses, so that, when one had to be looked up, it was necessary to know its class, and in the very uncertain scheme of classification then existing this sometimes necessitated a long search. By the numerical arrangement it is, of course, possible to find a drawing at once. The first ten thousand patents issued by the Government bore no numbers, so each of these is designated by a number corresponding to its order in point of date, and the letter "X" placed after the number to indicate that it belongs to the group of early patents. As fast as one of the original drawings is brought to light it is checked off on a list previously prepared; but the list contains still a few gaps where it is known that drawings must have been filed, but they cannot be found. In some cases old drawings have been discovered in hiding between the shelves and the wall, where they must have slipped down many years ago, and rested undisturbed because never called for.

The work of classification was not postponed to await the arrangement of the drawings, but was taken up concurrently with it. In some cases the titles of patents have been found very misleading, and it has been necessary to revise these in order to put the patents into the proper class and sub-class. Cross-references are also necessary between sub-classes of the same class, by reason of the presence of mixed matter in one patent here and there. A card-index system of sub-classes and other details has been perfected, which will make it possible to detect and remedy any omissions. As a protection against future changes of classification hereafter without ample reason and authority, the duty of classifying all future patents will be retained in the hands of the classification division. Aside from the great advantage to patent attorneys and searchers arising from the improved classification, it is believed that the establishment of the new division will have the effect of training a corps of expert classifiers, since classification, like any form of cataloguing, is a distinct art subject to certain recognized rules.

Naval Tests of Marconi Wireless Telegraphy.

A special despatch from London of August 5 says: The mimic war between England and Ireland, which began last Saturday, was brought to a close to-day. Sir Compton Domvile, with the British fleet, won, to use the language of the turf, in a canter. With the detached squadron was the Europa, which had been fitted in a hasty manner with the Marconi system of wireless telegraphy. In the other portion of the fleet, the Alexandra, Sir Compton Domvile's flagship, and the cruiser Juno, on which was Signor Marconi himself, had been also fitted with the system. The Juno was ordered to get in touch as soon as possible with the Europa on Monday afternoon. It was a little after 5 o'clock when the instrument in Signor Marconi's cabin gave some feeble ticks, and then a message was rapped out that the Europa had reached her convoy, and was coming to communicate the news to the flagship.

When the Juno received this message she was more than forty miles from the Europa, and more than seventy from the convoy. Turning about she proceeded back on her course, and at 7:30 o'clock, when still more than thirty miles from the flagship, she repeated the intelligence she had received from the Europa. A second message, sent in the same way, is mentioned by a correspondent, who estimated the distances of the Alexandra at the time as thirty miles from the Juno, fifty-five miles from the Europa and eighty-eight miles from the convoy. He says—and every one must agree with him—that it is a veritable triumph for Signor Marconi.

An Important Street Railway Move at Atlanta, Ga.

The contest over extensive street-car franchises in the City of Atlanta, Ga., has culminated in an offer made to the city by Joel Hurt, President of the Atlanta Railway and Power Company, which may mark the beginning of a movement for municipal ownership of street car, power and lighting properties there. The proposition is that, beginning with 1900, the dividends on the capital stock of the Atlanta Railway and Power Company and the Atlanta Railway Company shall be 4 per cent. for the first year, 5 per cent. for the second year and 6 per cent. thereafter, all dividends above 6 per cent. to be divided one-fourth to the stockholders and three-fourths to the city, to be used for street improvements and public schools. The company, acting with the city, is to lay out and build all extensions of lines which may be needed, and in the event of any disagreement between the company and the city, a decision is to be reached by means of a commission created by the State Legislature. The city is to have the right at any time, after twelve months' notice to the company, to purchase the properties by paying par for the stock after any dividend period, and assuming the bonded indebtedness. The company is to continue to pay taxes, but asks that the paving laws be changed slightly in its favor. All complaints and criticisms of the car service are to be left to an officer to be selected by the city who is to have authority to adjust the trouble; if he fails, he may refer the complaint to a commission constituted for the purpose and possessing wider powers.

Automobile Truck Competition in England.

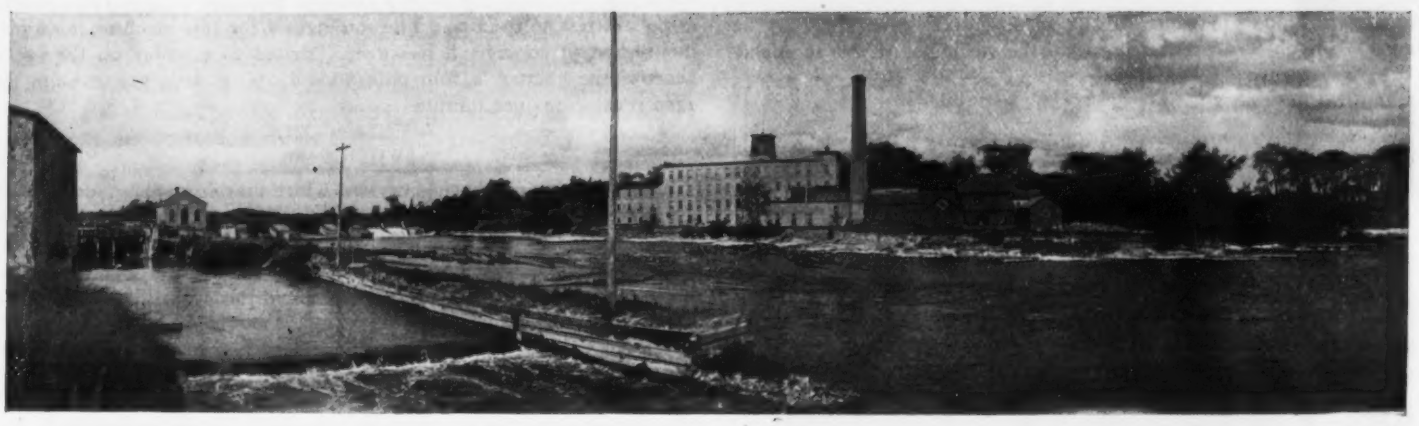
A special despatch from London of August 5 says This week the Self-Propelled Traffic Association had an elaborate series of public tests at Liverpool of motor wagons. Six different types of English-made wagons competed, carrying loads of from two to three and a half tons up steep, zig-zag, stone-paved gradients with smooth iron tires, which the Government by-laws prescribe as an element of safety. On the steepest gradient, one in nine, the motors stopped half way to test their power of restarting in the middle of the hill, and five out of six succeeded, the wagon built by the Thornycrofts, builders of the Shamrock, achieving the feat with the least apparent trouble.

The other tests included a thirty-five-mile ride through the thick traffic of the hilly Liverpool streets, along rough, heavy roads and over many high-graded railway bridges. All the wagons acquitted themselves satisfactorily. These tests were made at an average speed of 16½ miles an hour.

The Liverpool Corporation has recently introduced motor dust wagons, it is said, at a saving of 50 per cent. on the cost of haulage. All the great English engineering firms are now devoting their energies to the production of improved motor wagons, and this branch of manufacture is believed to have a great future.

Underground Wires in Boston.

In his annual report the Boston Wire Commissioner, Mr. Flood, says that with the close of the present year all wires in the prescribed district of Boston not exempt under the law will have been placed under ground. A very large amount of overhead wire not in the prescribed district has also been placed recently under ground and more will follow before the end of the year. The exempt wires are those of the long-distance telephone system and the overhead trolley wires. The report says that experiments in the line of telephone improvements, which may render it possible to place the long-distance telephone wires under ground, are progressing favorably, and that the time may not be long before those wires can be taken into the conduits. It is understood that the telephone companies are anxious, for their own purposes, to reach this result. The outlook for the final removal of the trolley wires of Boston is not so favorable, however. The Commissioner says that the act of 1894 did not, and the act of 1898 will not compel the removal of these wires. The fact that they are unsafe, and that they are serious obstructions in cases of fire, together with recent advances in the underground electric systems, may in time effect, however, what the law has thus far failed to bring about.



Canadian Water Power Plants—VII.

PLANT FOR ELECTRIC POWER SERVICE, PETERBORO, ONTARIO.

By E. M. Archibald.

IN the central part of the Province of Ontario, Canada, the region situated between Lake Huron with its deep indentation, Georgian Bay, and Lake Ontario, is variegated with lakes and rivers, and known as the Kerwatha Lake region. The lakes are in chains, and naturally follow the slope of the country towards Lake Ontario. The Otonabee River, some 32 miles long, connects Stony Lake with Rice Lake, two of this chain, passing in its course Peterboro, a thriving town of 12,000 inhabitants. From Rice Lake the Trent River, 30 miles in length, takes the flow of water into the Bay of Quinte, situated near the outflow of Lake Ontario.

As is well known, Lake Huron is at a great elevation above Lake Ontario, in fact some 335 feet, and we should indeed be surprised did we not find that some of the water in this region is available for industrial purposes; nor are we wrong, because for many long years it has aided the great lumbering industry of Canada not only by carrying the logs down but also serving to operate the numerous sawmills and gristmills situated all along its banks. At Peterboro, which is quite a manufacturing centre, are located the shops of the Canadian General Electric Company, Ltd.

There have been several dams constructed spanning the Otonabee—the majority of them quite old and only about half a mile apart, the average head obtained at each being about 12 feet. One of these dams is used to make the stored water deliver up its potential energy in driving the turbines of a large woolen mill, an underwear factory and an electric plant owner by the Auburn Power Company, Ltd., which plant it is here purposed to describe.

The Auburn Power Company was organized early in 1897, and after having purchased the still standing portion of an old gristmill, previously destroyed by fire, they proceeded to evolve a power house. By March of the same year, operations having been carried on with unusual diligence, power was being supplied in Peterboro from this power house.

HYDRAULIC DEVELOPMENT.

The old dam erected in former years was untouched, but the head race was repaired, the total outlay being but a small sum. This dam for storing the water is of cribwork, 300 feet wide, extending from bank to bank, and is supported by six cribwork piers filled in with rock. Between these six piers there are sluices, any of which may be opened or closed by raising or lowering flash boards by means of a windlass at the top. These, although wasting a large quantity of water, are necessary to allow the numerous logs descending the river in "drives" to pass to their respective destinations—the sawmills. These sluices are of various sizes, varying in width from 12 to 20 feet; the largest being opened in the spring to permit the large "drives" to pass through; the large quantity of water lost at that season of the year by this means is but a unit and unnoticed, but later during the dry season in the latter part of the summer only the smaller sluices are opened, and these only when absolutely necessary.

At one side of the river are situated the Auburn woolen mills, their machinery being operated by turbines driven by the water above this dam. On the other side—the Peterboro side—are situated the power house of the Auburn Power Company and the Peterboro Underwear Company's mills, both taking water from the same head race, an extension being necessary for the latter mill on account of being located farther down stream.

This head race is somewhat irregular in form, due to the projection of the foundation of the old gristmill, one part indeed acting as a retaining wall. This wall is of masonry 6 feet thick at the bottom and tapering off to 3 feet thick at the top, and is very solidly built. The inner side of the head race is the river bank, supplemented in place by a small amount of masonry. In length, the head race is 300 feet, while the minimum transverse dimensions are 30 feet wide by 8 feet 6 inches deep, producing a cross-sectional area of 255 square feet. The normal head obtained is 12 feet, but this rises at certain seasons to 15 feet.

At the entrance a diagonal wooden boom is located to prevent any rubbish, floating driftwood, etc., from entering the head race, this being swept away through a waste gate 12 feet wide. Wooden racks are placed a short distance from the entrance to the penstock to arrest any floating débris which may have escaped the boom from entering the penstock and injuring the wheels.

Practically no trouble has been experienced with frazil or anchor ice, and not the slightest difficulty with snow or slush clogging the racks. As explained in a previous article, frazil ice is formed in rapidly flowing water in long, fine crystals taking the shape of a needle, and is in fact sometimes known as "needle ice." As soon as its motion is arrested or retarded sufficiently it forms a solid mass of ice. Anchor ice is the term applied to the ice that adheres to the rocky bed of a stream during ice formation. Any medium interposed to prevent radiation, such as surface ice, will tend to check its formation, the temperature of the water under surface ice being above the freezing point; consequently the anchor ice at the bottom will immediately rise to the surface. Thus, neither frazil nor anchor ice can form under cover, because, as previously stated, frazil can only form in water moving with such rapidity as to prevent the formation of surface ice; hence one method to obtain complete riddance of these two bugbears is to maintain a body of slowly moving water in the head race, the surface of which will freeze over very quickly. Such is the plan adopted here and in many other of the Canadian water-power plants.

But this is a digression, even though it may be to some purpose. To return—water from the head race enters the wheel flumes at both the front and the side through wooden head gates which may be closed when necessary. From the wheel gates it flows through an opening to the penstock 12 feet wide by 9 feet 9 inches high. After passing through the wheel pits it drops into the tail race which it reaches through three stone arches in the rear of the power house, of which two are 14 feet wide by 7 feet high and the remaining one 6 feet wide by 7 feet high, the whole three being of ample capacity for freely disposing of all the water.

The tail race, 7 feet deep by 250 feet long and some 40 feet wide, is the same as was used by the old gristmill during its period of activity. Here the water returns to the river, but is separated from it for 250 feet by a cribwork pier 15 feet wide, parallel to the shore. At the outlet of the tail race where the water re-enters the river, a cofferdam has been erected to prevent the water in the tail race from falling below the level of the draught tubes, as it would otherwise do during low water.

POWER HOUSE.

The power house is a one-story stone building 60 feet in length by 38 feet in width, built very substantially, the walls being 3 feet thick. It is divided into three parts, separated by wooden partitions,

viz., the generator room, off which the switchboard is partitioned, and the storeroom, in which at any time, another generator may be placed. The object of thus separating the switchboard was to enable

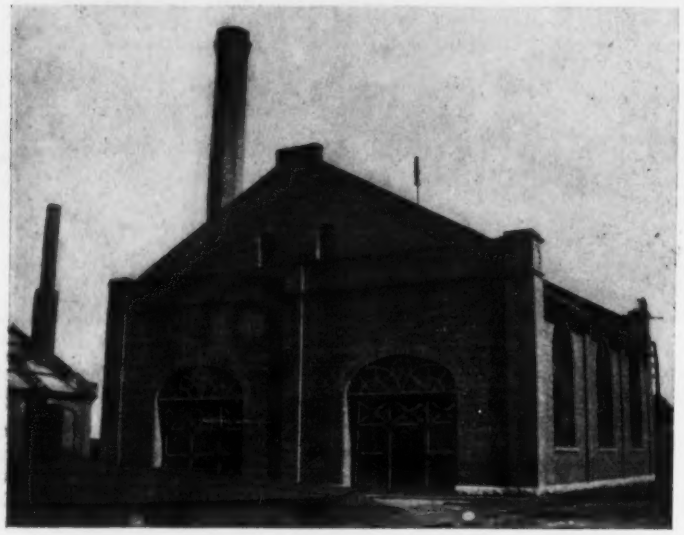


FIG. 1.—CANADIAN GENERAL ELECTRIC SUBSTATION.

the attendant to retain some degree of warmth, during the cold winter, by means of a stove placed here. In order that he may observe the operation of the machinery at all times, a great portion of the partition is of glass.

The hydraulic equipment consists of two 56-inch vertical improved "Sampson" wheels each capable of developing 250-hp at 100 revolutions per minute under the normal head of 12 feet. They are placed in one flume, as shown by the diagram, separated 20 feet apart between centres and are connected by means of heavy mortise bevel-gearing to a 6-inch jackshaft operating at 200 revolutions per minute, to which the generator is rigidly connected. The heavy gears are encased in a large wooden cover, thus protecting the attendant from this danger.

These turbines are regulated by a hand wheel placed directly in front of the switchboard, which by means of suitable gearing and shafting, opens or closes the guide blades of both wheels at the same instant, thus allowing a greater or a less quantity of water to enter the wheel chamber. Hand regulation was adopted on account of the freedom from great fluctuations of load, power being supplied solely, which remains in operation after once starting in the morning.

These wheels, together with all the jack shafting, etc., were built and installed by the Wm. Hamilton Manufacturing Company, Ltd., of Peterboro, the manufacturing and selling agents in Canada for the James Leffel Company, of Springfield, O.

The electrical generator is rigidly connected to the jackshaft and has a capacity of 250-kw at 200 revolutions per minute. It is a Canadian General Electric three-phase machine of the ordinary type with stationary fields and revolving armature, the current being collected by slip rings; it has 36 poles and generates current at a frequency of 60 cycles per second and at a pressure of 2400 volts, delivering it direct to the line. The foundation for this machine is an immense bed of concrete 8 feet deep. Belted to a pulley on the jackshaft is the exciter, a four-pole 9-kw C. G. E. machine running at 1400 revolutions per minute.

SWITCHBOARD.

The switchboard consists of two white marble panels mounted on an angle iron frame and is placed at a distance of 4 feet from the wall. The first is the machine panel, and contains three fuses in enclosed fuse blocks; generator voltmeter; exciter and generator ammeters, the latter indicating the current in one leg; three single-pole single-throw main generator switches; a double-pole exciter switch and, lastly, at the bottom the exciter field and generator field rheostats.

The second is the line panel, and has connections for four lines, though but three are in operation at present. Here are the three enclosed fuse blocks for the three wires composing each line, two ammeters under which are placed two four-pole slide switches connected in such a manner that any circuit desired may be thrown on the ammeter and the current indicated, and the four triple-pole single-throw line switches.

Coming now to the back of the board, here are placed the bus bars of bare copper, but protected from accidental contact by a wooden rack; the usual lamp ground detector; the three lightning arresters type "L" C. G. E. make, and the three choke coils in the generator circuit. The power house and switchboard are lighted by incandescent lamps supplied from the exciter.

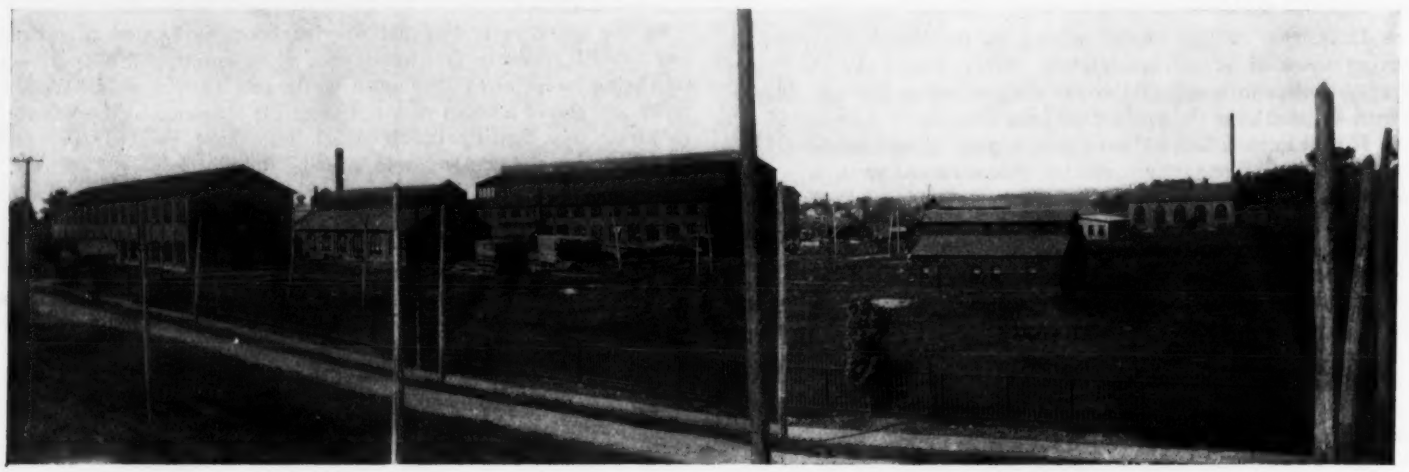


FIG. 2.—CANADIAN GENERAL ELECTRIC COMPANY'S SHOPS, PETERBORO, ONT.

From the switchboard the circuits pass up to the roof trusses in band porcelain insulators, thence to the line through a wooden frame on the end wall. From here two lines run to Peterboro, while the

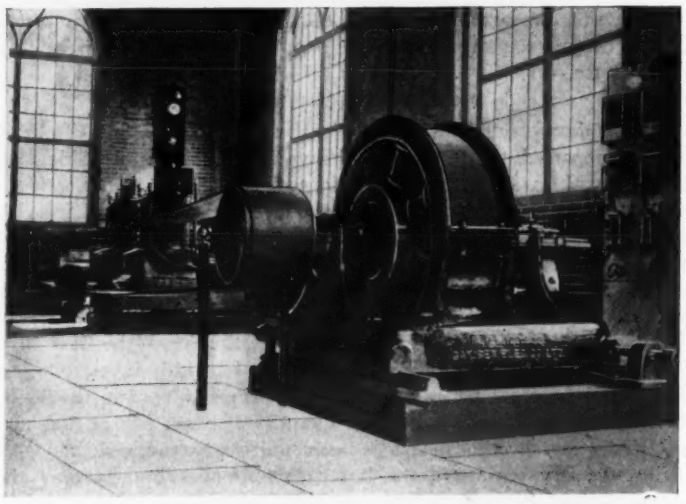


FIG. 3.—INTERIOR OF SUBSTATION.

other crosses the river and supplies light to the Auburn woolen mills.

POLE LINE.

Of the two lines one runs direct to the shops of the Canadian Gen-

eral Electric Company, and the other is used for ordinary power service throughout the town, off which taps are taken as required.

For the former the transmission line is three miles long and consists of three No. 2 B. & S. weatherproof insulated wire, while the latter is No. 4 B. & S. The two three-phase lines are placed on two cross-arms, one line to each, securely fastened to the ordinary double petticoat deep grooved glass insulators and placed 18 inches apart. The cross-arms, which are six-pin, are 22 inches between centres and are supported by two 30-inch iron braces. The poles are of white cedar varying from 45 to 50 feet high in the country to 65 and 70 feet inside the town, each 7 inches in diameter at the top, embedded 6 feet in the ground and spaced 120 feet apart. The line drop is 7.5 per cent. at full load.

At a distance of some 200 feet from the power house is the Peterboro Underwear Company's factory, and here two 10-kw C. G. E. transformers, type "H," are placed on the pole across the three-phase service line; here the pressure is reduced to 110 volts and operates a three-phase 20-hp C. G. E. induction motor which drives all the machinery on the upper floor, that on the lower floor being operated by belts direct from turbines, the water being supplied in a wooden flume, a continuance of the power house head race.

SUBSTATIONS.

Situated on Simcoe Street in an enclosed portion of a grain elevator is the main service substation. Here is located a motor-generator consisting of a three-phase 75-kw induction motor operating directly from the line pressure, coupled direct, by an insulated flexible coupling, to a 50-kw 550-volt four-pole direct current generator, both machines being Canadian General Electric apparatus.

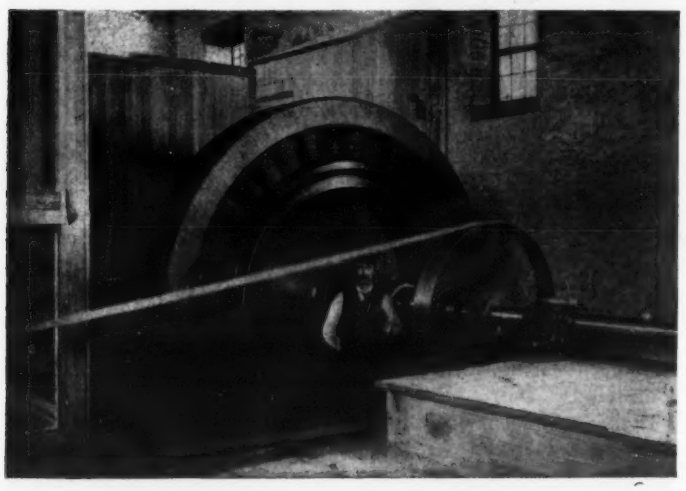


FIG. 5.—250-KW THREE-PHASE GENERATOR.

The induction motor has a revolving starting resistance which is gradually cut out by hand as the speed increases. All the grain elevator apparatus is operated by belting from a pulley on the motor shaft.

The conversion into direct current was necessary to provide for the many customers who had already installed direct current motors, for

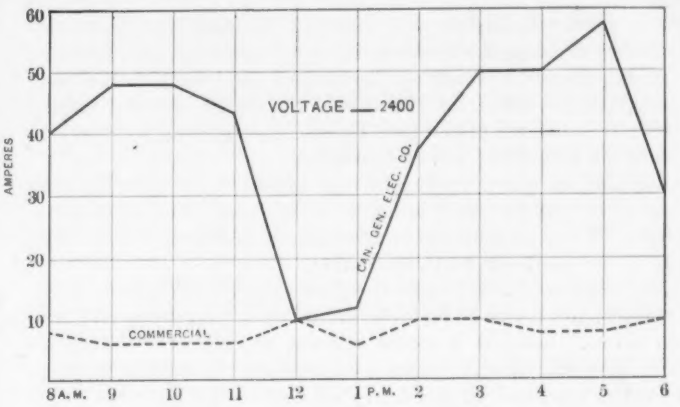


FIG. 6.—LOAD CURVE JULY 7, 1899.

which power was formerly supplied by another company now in the lighting business only.

The switchboard at this substation consists of two white marble panels mounted on an angle-iron frame.

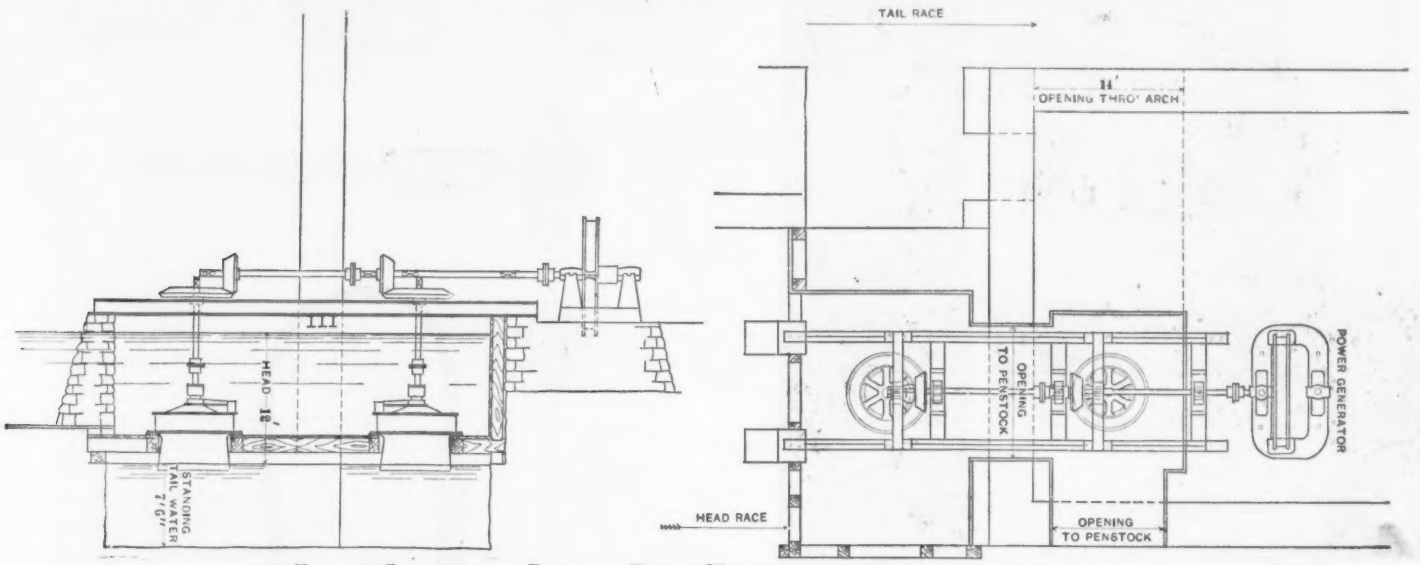


FIG. 4.—SECTION AND PLAN OF POWER HOUSE OF AUBURN POWER COMPANY.

The induction motor panel contains the three-line fuse blocks and the main triple-pole motor switch, while placed on the back are the three lightning arresters and choke coils for lightning protection.

The direct current generator panel contains the voltmeter, line ammeter, field rheostat, the main double-pole generator switch and the two-line fuse blocks, in the order named; also the two lightning arresters and choke coils on the rear.

In the direct current power distribution all the main branches running from the feeders are fused.

The substation at the Canadian General Electric Company's shops is, of course, the main point at which power is to be supplied, and is an isolated one-story brick building 58 feet long by 54 feet wide. The electrical equipment of this substation consists of a three-phase 100-kw C. G. E. synchronous motor with eight poles, and thus revolves at 900 revolutions per minute; it is belt-connected to two 60-kw bipolar C. G. E. direct-connected machines, which supply the motors operating all the machinery in the various buildings. There is also a synchronous motor similar in size and type to that already mentioned, which operates from a jackshaft the arc machine for lighting, the alternators for high potential work and for the incandescent lamp testing. This is also for the tests on the various machines.

The switchboard in the substation consists of four white marble panels mounted on an angle-iron frame. The first two panels to the left are for the direct-current machines and are similar, each containing three fuses, one in each lead, an ammeter, a voltmeter, a single and double pole main switches, the extra pole being the equalizer connection, and lastly the field rheostat.

The third panel is for the synchronous motor, and contains the

three enclosed fuses for the three-phase circuit, two ammeters, a double-pole field switch, a triple-pole armature switch, and lastly the field rheostat.

The line panel contains the line terminals passing through three enclosed fuses through the choke coils, taps being taken off to type "L" lightning arresters placed on the back of the board, to the two triple-pole main switches for the two synchronous motors; under these latter switches are placed two Thomson integrating wattmeters to measure the amount of power consumed.

Notwithstanding the excessive current drawn when starting, the synchronous motors are both brought to the speed of synchronism direct from the line without the intervention of a starting motor, and this, too, in the short space of one minute.

As their fields are excited from the direct-current machines belted to themselves, there can be no field excitation at the start, and the question arises, How can a motor operate, especially at the start, without a magnetic field? When we look into the matter we find that a field is produced by the heavy current in the armature, and without going into full details, the machine starts and runs by armature reaction. Of course, when some speed has been reached the fields of the direct-connected machines soon "build up" and current is generated, part of which excites the synchronous motor fields.

In the event of a "shut down" at the power house, a small steam

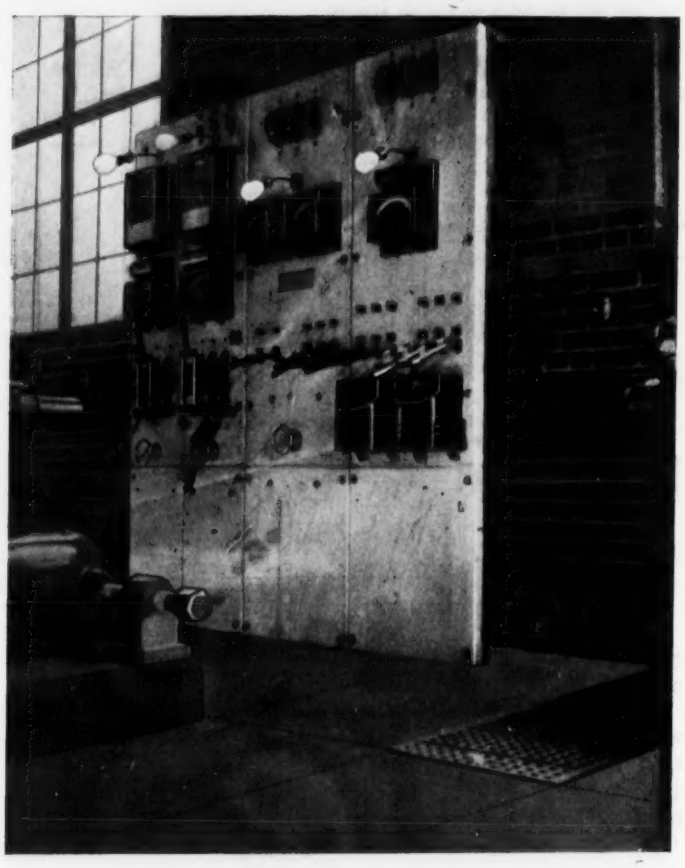


FIG. 7.—SWITCHBOARD IN SUBSTATION.

plant is in readiness at this substation to begin operating for the supply of these shops, but it is used only as an auxiliary to the water power. This auxiliary steam plant consists of a 200-hp "Brown" engine running at 80 r. p. m.; two water tube boilers, one manufactured by J. Inglis & Son, Toronto, and the other by the Wm. Hamilton Manufacturing Company, of Peterboro; a Northey duplex feed pump and a Mitchell & Company's, Montreal, injector, to be used as an auxiliary to the pump.

The Auburn Power Company sells power alone, and there is another electric plant in Peterboro which supplies current for lighting alone. The explanation of this anomalous condition is simple. After the second company had commenced operations, each knowing that competition would mean ruination, an agreement was entered into that each should take up one branch of the business and hold to it; so it still remains.

Power is very cheap in Peterboro, the rate being but $20 per horse-power per year for three-phase machines, or $30 per horse-power per year for direct-current machines in any size of unit.

The fluctuations of load are very slight, the greater part continuing in operation after once started except between 12 and 1 o'clock. This is clearly shown by the load curve, one part of which is the power consumed by the Canadian General Electric shops and the smaller curve the ordinary town service.

The officers of the Auburn Power Company, Ltd., are John Carnegie, president; Jas. Kendry, vice-president; W. H. Meldrum, managing director and Jas. H. Greer, electrical superintendent.

Concentric Wiring.

BY MERVYN O'GORMAN.

SOME years ago Prof. Ayrton said that house wiring may be estimated "by the mile." He used the symbol $5p$ to express the price in dollars per mile run of casing, fuses, switches, electroliers (pendants or brackets), lampholders, shades, lamps and labor.

Cable is, of course, sold per mile and the price is a function of the resistance. Thus, for ordinary sizes $\left(54 + \frac{605}{r}\right)$ dollars is the price for 600 megohm grade rubber cables and the total cost per mile of house wiring is $\left(5p + 2\left(54 + \frac{605}{r}\right)\right.$ dollars.

Take a special case and let four dollars be the total cost per lamp installed, 50 feet the average distance of a lamp from the meter and 1 per cent. the allowable drop of volts at 100 volts pressure. We

FIG. 1.—PENDANT AND WALL SOCKET.

find that the part of the total cost which refers to buying the wire comes out at half a dollar. We also find that doubling the drop of volts only affects an economy per lamp of 18 cents, and that generally "the householder will gain in pocket by instructing the contractor to use the thickest possible copper wire throughout the house, short of making radical changes in the cost of chasing, casing, jointing and labor."

A system therefore which allows of much thicker conductors, less chasing, no casing, little jointing and less labor must be favorably considered.

This is the only form of electric wiring which can cause no external magnetic field and therefore no disturbance to the compass needle, and it is therefore becoming daily more important for ship work. It also deserves more attention for factory and country house plants as well as for town supply than appears to be generally given it in the States, when regard is had to its economy and mechanical qualities.

There are three obvious points for concentric wiring:

1. That the inner wire cannot be touched without first traversing

the outer, so that the effect of a leak or "short" is confined to the cable and can only blow a fuse and cannot cause a fire.

2. That two separately covered round insulated conductors take up more room and therefore require more "chasing," larger conduits, or heavier casing.

3. That no matter what voltage is applied between the concentric conductors, the voltage from the outer to *earth* is approximately nil.*

It is natural in view of this third point to use *no* outer dielectric and thus to save not only the rubber or lead that would otherwise be required, but also to use a cheaper and harder metal than copper for the outside conductor. Whenever a conductor must be

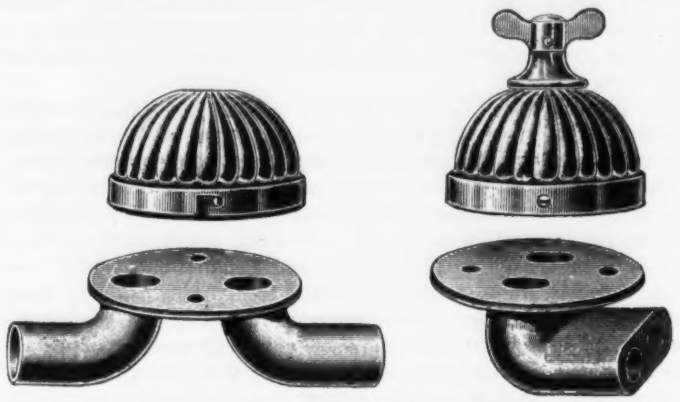


FIG. 2.—FUSE AND SWITCH OUTLETS.

sheathed in insulation, it is essential that it should be compact because of the cost of insulation, and as compactness is at present only obtained with copper, our thanks are at once due to the concentric system for half freeing us from the trammels of the coppering. One result of this is that the external wire may be made so large and the loss of pressure in it so small, that the inner conductor takes the whole allowable drop of volts.

This diminished diameter of the inner wire not only means less copper but less dielectric, which repays the cost of the stout and "mechanical" outer tube. Also in proportion as the outer tube is smaller, an increased thickness of metal is required for the same conductivity, and makes the protection still more effective.

The materials made available as conductors by the concentric system are brass, iron, wires, zinc, aluminum, lead, "compo," hard drawn copper tubes, split iron tubes, etc., most of which it would not pay to insulate externally.

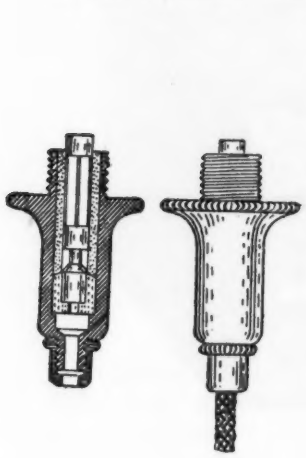


FIG. 3.—PENDANT HEAD AND FUSE.

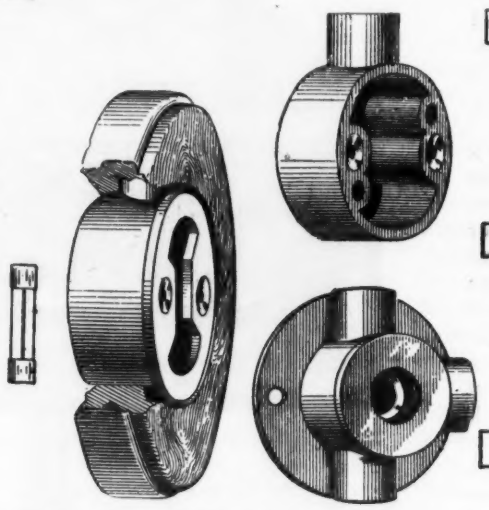


FIG. 4.—ANDREWS' OUTLET BOXES.

Some of these are valuable for ornamental surface work, and some for paper mills or cold storage warehouses (where lead and rubber won't survive), for example: a lacquered copper sheath in the latter, or embossed brass tubes for the former. Iron gas pipe through which a covered wire is drawn makes a cheap and strong concentric system in which an allowance for extensions and repairs is easily made. The same and other advantages attend Mr. Bathurst's plan of using bare copper drawn into his steel tubes which are insulated internally.

A prospective drawback of this system, the interference with telegraphs and telephones, has been proved by extended experience in the English town of Guildford (which has been lit exclusively in this way) to be a bogey. Electric tramways with rail and earth returns are far greater disturbers of the peace of single-line telegraphs than the most unruly central station could hope to be. If the electrolytic effect of the currents is feared as an unknown and dangerous variable, this fear need not exist with concentric lighting because the use of alternators would remove all danger without inconvenience; nevertheless no trouble has occurred or is feared with the direct-current used at Guildford. Another alleged disadvantage of the system is the difficulty of pouring molten solder into an inverted pocket in the ceiling, a difficulty avoided by the use of a little slack cable and common sense.

Lastly, there is for the supply of materials a healthy competition only marred from the purchaser's standpoint by the various pioneers each adopting patented or registered patterns of fittings, couplings, through junctions, blind ends, nipples, switchblocks and whatnot which are for the most part not interchangeable with other makers' goods.

Thus the fixing holes on one maker's switch bases do not correspond to the switches of another, the threads used on one conduit will not fit the three-way box of another and so on to minute

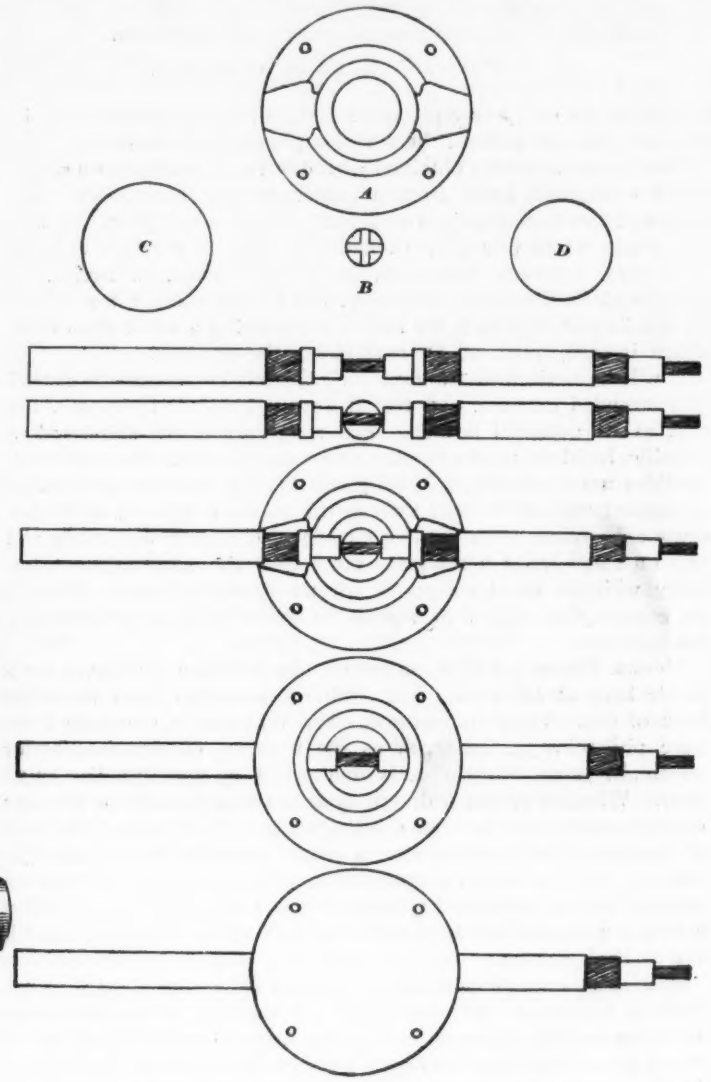


FIG. 5.—CONAMOR SYSTEM OF CONNECTING.

details. This attempt to restrict purchasers to the original suppliers may help the protected survival of wood casing.

In casing work two wires are carried through the ceiling or wall and left to dangle till a ceiling rose or bracket of any make is selected. In concentric wiring, loose ends are not left in this way: a screwed socket forming part of the outer conductor is firmly erected by the wireman and the bracket or pendant cannot be attached save by a screw and central contact which must correspond (Fig. 1). It is true that this screwing makes a thoroughly

*The qualification "approximately" is necessary because the capacity of the inner wire to earth is not quite zero, and we know that the P. D. to earth of concentric insulated conductors is inversely as their capacity to earth. Where a cable is required with the outer conductor insulated, many makers utilize this fact by putting only half as much insulation outside the conductors as they use between them. The earthed return conductor is merely an extreme case.

"mechanical and waterproof job," and it would be a convenience and a merit if the pitch and size of these screws were made to one standard by all.

The advantage of imperviousness to water more than outweighs this defect, which will disappear as the makers extend their sales and work together.

To complete this water-tightness of the system, screw lamps are used, and if a fitting breaks down, the lamp may be screwed directly into the socket in the wall or ceiling. Similarly, a new fitting may

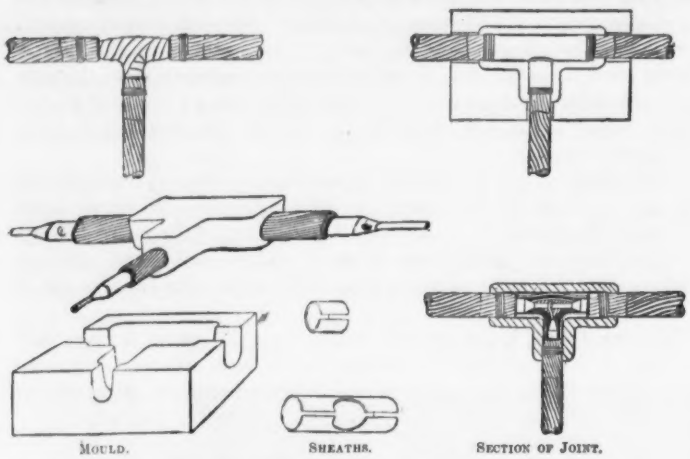


FIG. 6.—"SAFETY" SYSTEM OF CONNECTING.

be inserted as easily as replacing a lamp, or an extension made in the same manner without the aid of a plumber or wireman.

These advantages are obtained by a departure from present usage which commends itself from a manufacturing standpoint. The pendants, flexibles, brackets and fittings are issued from the factory ready wired (see Fig. 1), and the labor of erection reduced to turning a screw. Similarly, fuses which must, of course, be introduced in the inner wire only, are supplied ready for fixing. As will be seen in Fig. 3, the fuse is contained in a small glass tube, which is easily replaced by unscrewing the pendant.

It will be noticed that a concentric flexible has a smooth instead of a stranded exterior, and that it does not attract and retain the dust as its potential is zero. For rough work on shipboard a metallic braid is used as outer and sheath. In concentric work flexibles are exceptionally strong, for in any case the conductors to single lamps are heavier than in the two-wire system, partly because a complete circle is always made of the outer conductor and this on small inner wires gives more than the necessary conductivity with the usual gauges of wire; and partly because there is no economy of rubber or silk to be made by cutting them very fine.

Messrs. Mavor and Coulson use no wire less than 721½ even for a single lamp at 220 volts. Mr. Andrews is said to favor the same limit of size. Their competitors claim that this is not done from pure philanthropy, inasmuch as the number of accessories for terminals, joints, fuses, etc., is diminished by avoiding the small sizes. Whether or not a design of accessories suitable to all sizes could be made, the fact remains that in any house wiring, the cost of increasing the conductivity is small compared to the most of cutting away, erection, piercing the walls, supplying the switchboards, making good and redecorating and "it pays" well to adopt a very low drop of volts, ½ per cent. with all lamps alight, according to Prof. Ayrton.

It must not be supposed that ordinary fittings and brackets are entirely impossible for adaptation; for example, a single design is shown in (Fig. 4), an outlet box (by J. D. Andrews) which can be wired by a concentric flexible to any bracket attached to the wood block.

Indeed the wiring is often concentric only as far as the ceiling rose or wall socket, after which an ordinary twin flexible is allowed. Some houses in Guildford have pendants wired in this way; similarly, pear switches hung by twin flexibles from a joint box inserted in the cable where it passes over the door of a room. This avoids the necessity which concentric wiring otherwise involves of bringing four conductors down to every switch.

The objections to these departures from absolute concentricity seem to be unimportant in dwelling houses which are kept reasonably dry. The economy made is small, and the use of twin wire can be avoided by another simple plan—the use of a good pull-switch and cord.

In concentric as in other work the permanency depends on the cables. These may be without expense of better class than usual owing to the small amount of dielectric required by the system.

To test the dielectric thoroughly, it should be immersed in water for a day, treated to 1000 volts for an hour on the full length, and then measured for megohms. Above 10 megohms per mile, it does not matter whether the test be high or low, but some such results as 600 megohms per mile on cables of 1" outside diameter at 60° F. has been easily attained by the makers, and is to a certain extent a proof that clean and dry materials were used. It is no proof, however, that porous rubber, badly vulcanized, and loaded with powders of various kinds, was not employed, neither does it show the absence of lead exide pinholes, slits or punctures in the lead cores tubes.

The important test is the next one. Allow the cables to soak continually for a week after the first megohm test, take insulation once more and if there is *no falling off* the cable may be passed.

The above test may be made more severe simply by extending the time interval between the megohm tests and is especially valuable in view of the temptation to employ less Para, negro head, or lagos strip. In these days of dear rubber and cheap French chalk, lead covered cables are especially fascinating to concentric wiring firms, not only because paper or fibre dielectric is cheap, but because the lead adds its quota to the conductivity is well understood by the plumbing fraternity, and it can be soldered water-tight by a "wipe" to the tinned nozzles of joint boxes, or by simply pouring into a pocket some low temperature solder after the cable is inserted and trimmed.

The inventors of the "Conamor system" prefer to make use of boxes, and the instructions they issue are as follows:

Prepare the cables as shown in Fig. 5 as follows:

Cut away the lead sheathing and the outer conductor for a length equal to the diameter of the central chamber of the junction box.

Remove the insulation to expose a sufficient length of the core to allow of the central contact button being soldered to it.

Remove the lead sheathing to expose the copper of the outer

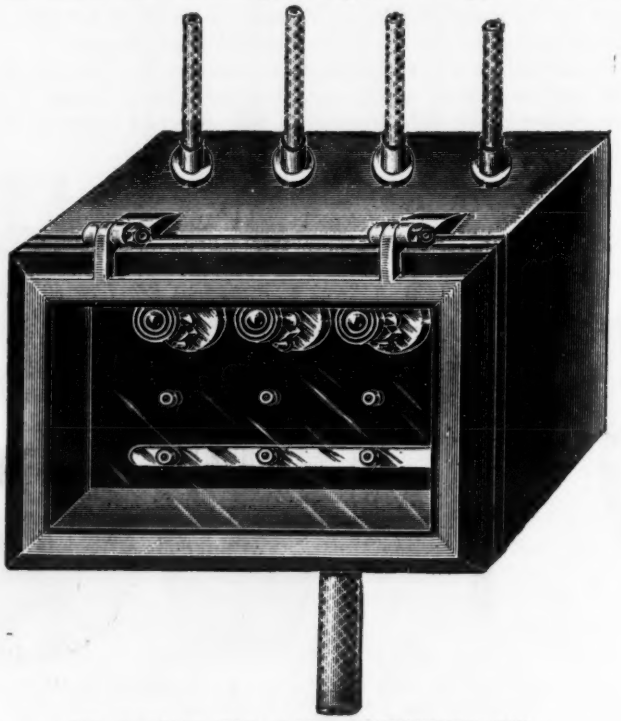


FIG. 7.—CAST IRON GLAZED DISTRIBUTING BOX.

conductor at the points corresponding with the jointing pockets of the junction box, but leave sufficient lead sheathing projecting into the pocket to ensure its being properly jointed thereto. An annular strip of lead sheathing, an eighth of an inch wide, should be left to fill the opening to the central chamber and prevent the solder flowing into it.

If the outer conductor is not already tinned, the parts exposed for the jointing pocket should be carefully tinned. Solder the contact tip to the inner conductor, as shown. Lay the conductor into the junction box, as shown.

Fill the pockets (*a* and *b*) with solder, using resin as a flux. A heavy soldering bolt, a melting pot and small ladle, or a jointing lamp may be used (a jointing lamp is to be preferred, except for large junctions), and care must be taken to heat the junction box sufficiently to make the tinning of the jointing pockets run.

Lay the insulating disc (*c*) in the central chamber of the junction box.

Lay the tinned brass disc on the back of the junction box (*d*) in the tinned recess provided for it, and solder it to the box. The junction is then complete.

The above describes the process of making a throughway junction tapped for a fitting; and all other junctions, whether tapped for fittings or blind, are similarly effected.

When jointing armored cables, each strand of the armoring should be separately tinned before the cable is placed in the junction box.

Another excellent method of jointing adopted by the Safety Concentric Company is shown in Fig. 6. It is effected as follows:

Cut back the armor and outer conductors exposing the insulation of inner wires; joint the inners in the usual way, and then insulate with, first a layer of pure rubber, then vulcanizing rubber and finally with silesia strip. Over the joint now insulated, clamp a sheet of tinned copper and place the joint in an earthenware mold. Fill the mold with fusible metal and when cool the thing is done.

For internal work it is quite common to cleat covered cables to the wall without any protection outside the lead. In the absence of armor the conductivity of the outer is made up with copper tape on small sizes and wire on larger cables. Although it is more expensive to put the copper tape or wire under the lead than outside it, the former should be insisted on. The author has known galvanic action between the different metals to ruin a cable in a couple of years. For the same reason brass cleats must be avoided and lead tags alone used to suspend the cables for surface work. A few copper wires are used to make up the conductivity of the "outer" in small armored cables, the iron armor being here and there replaced by copper. The object of this is to enable an armoring wire of extra small gauge to be used. The practice should be limited to exceptional cases where space is limited and the locality dry.

Owing to switches being single-pole, a great simplification and economy is obtained and practice shows that it is optional to an enlargement of the outer conductor, or to secure that the outer shall be of full conductivity at the board by a simple system of links, or a concealed cable.

In some cases a glazed wooden case is used to cover a slate switch base, or an iron box with an iron lid is adopted at a subdistribution box. Every modification of subdistribution board, ornamental and plain, has been produced during the last few years, and the grouping of fuses and switches under one cover or on one board (Fig. 7) gives, of course, no difficulty.

In conclusion the author begs to thank Mr. Bathurst, Mr. Mavor, Mr. Andrews, Mr. Money-Kent and the Safety Concentric Company for the kind assistance which they have rendered and the information they have given about various systems of which they are the best exponents. Special thanks are also due to the National Electric Wiring Company for a long letter containing much valuable criticism, free use of which has been made in the foregoing article.

SUMMARY.

The concentric is the system for ships because of the compass, for land because of economy.

Its advantages are three: No leakage of current, less rubber and chasing, no shocks or fires.

Its drawbacks are: 1. Alleged interference with telegraphs and telephones. 2. Trouble of pouring molten solder into an inverted pocket in the ceiling. 3. Screwed fittings not standardized.

Its boxes, etc., junctions and ends are factory made and interchangeable for almost all sizes of cables and lamps, but will take ordinary fittings, switches, pear presses and flexibles.

Its flexibles are strong, smooth and don't attract dust.

Its cables and wires may be the best possible with great economy.

Its joints are either in special boxes or are cast and vulcanized on the spot with ease.

Switching boards are cheap, compact, through being *single*-pole; they may be enclosed in an iron box, or in glazed teak cases.

Fuses and distribution boards offer no fresh difficulties, electrically or æsthetically.

The Energy of Carbon.—I.

By C. J. Reed.

THE maximum available energy of any source is the quantity available in the form of heat.

The chemical reaction which takes place between carbon and oxygen with the formation of carbon dioxide (CO_2) evolves a greater quantity of heat per unit of carbon than any other reaction between carbon and a chemical element. As this is the reaction which takes place when carbon burns in the air, we obtain by such combustion the maximum energy obtainable from carbon as an element. The fact that certain chemical compounds (in the building of which energy has been expended) may, in oxidizing carbon, evolve a somewhat greater quantity of heat than that obtained by the direct combustion of carbon in oxygen, is due, not to any increase in the energy obtainable from carbon, but to the simultaneous liberation of at least a part of the energy previously expended in the formation of the oxidizing agent. If, for illustration, carbon be oxidized by potassium chlorate instead of free oxygen, the chlorate is reduced to chloride by the operation and thereby gives up previously absorbed energy, and the total amount liberated will be about 107 per cent. of that obtainable from the same carbon burned in gaseous oxygen. But this additional energy can not be considered as coming from the carbon. The only energy that can come from the carbon in its oxidation is that which would be required to separate the carbon and oxygen from the oxide formed.

The quantity of heat obtainable from the combustion of solid carbon and gaseous oxygen with formation of gaseous carbon dioxide (CO_2) is about 8080 gram-calories per gram of carbon, or 96,960 gram-calories per gram-atom (12 grams) of carbon. The equivalent of this heat, expressed as energy in other forms, is, per gram-atom of carbon, 41,100 kilogrammeters or 297,000 foot-pounds of potential energy, 0.112 kilowatt-hour of electrical energy or 0.15 horsepower-hour of mechanical energy or work.

While it is thus possible to express the quantity of heat energy obtainable from the oxidation of carbon as the equivalent of energy in other forms, it has not yet been possible to obtain the same quantity of energy from carbon in any of these other forms, either directly or indirectly.

When two or more elements combine to form a chemical compound without the influence or mediation of another element, agent or carrier, the combination is said to be *direct*. When a combination of elements is effected only through the mediation of an auxiliary substance, whose function is to enter into temporary combination with one of the elements and subsequently pass out again by displacement, acting only as a carrier, the combination is indirect and involves the substitution of one substance for another.

The term "direct," as applied to alleged methods of obtaining electrical energy from carbon, does not refer to the kind of chemical reaction involved, but has generally been used to imply that in the operation or series of operations the energy does not at any stage assume the form of heat. With this omnibus meaning of "direct" the problem of getting electrical energy "directly from carbon" ceases to be of special interest, since it was the first method known to man of getting electrical energy from any source except a static discharge and it has been in constant use as long as zinc or iron have been employed in galvanic batteries.

The problem which is of interest at the present time is not one of directness or indirectness, but one of commercial economy and practicability in competition with heat engines.

For the purpose of an inquiry into the possibilities and limitations of this practical problem of transforming the molecular potential energy of carbon (energy of chemical separation) into available forms, such as electrical, kinetic, and molar potential energy, without the use of thermo-dynamic or thermo-electric methods, it will be convenient to consider separately two kinds of processes, one of which may properly be called direct and the other, indirect. Under direct methods will be included all those, in which there is only a single change that can be isolated or distinguished in the energy; that is, a single transfer or transformation of the energy in passing from the original to the final condition. Indirect methods include all those, in which the energy undergoes two or more successive changes (either transfers or transformations) that can be distinguished or isolated in passing from the original to the final condition or form. Indirect methods or processes necessi-

tate permanent, or at least recognizable, intermediate conditions of the energy between the original and the final states.

This distinction is important from the fact that each of such changes necessitates a loss (generally great) in the form of unavailable heat, and from the fact that the maximum efficiency of any direct or single change in energy can never be increased by adding an intermediate change. When the maximum efficiency of any direct transformation is determined, it can not be improved by indirectness of any kind.

The availability of energy in the form of electrical, kinetic, or molar (as distinguished from chemical) potential energy, is generally all that could be desired, since the transformation and application of these forms may be accomplished with the highest efficiency. If, therefore, the greater part of the energy of combination of oxygen and carbon could be obtained in any of these forms, either by a direct or an indirect process, the problem would be practically solved, regardless of the number of intermediate changes that might be necessary.

The direct production of kinetic or of molar potential energy from chemical action under any circumstances is very doubtful. The kinetic energy produced by an increase in the volume of a system undergoing chemical change is probably always due to the absorption of heat, either external or generated within the system. The only forms of energy, therefore, except light and heat, which are to be considered as possibly obtainable from carbon, are chemical and electrical energy.

That chemical energy may be obtained from carbon by oxidizing it in the reduction of metallic and other oxides is too well known and universally practiced to require in this connection more than a mere recognition. The chemical energy thus obtained is, however, in the same form as that in which it existed in the carbon and is simply transferred from the carbon to the other substance without transformation. Any transformation of this energy must be accomplished by a subsequent process. Such a process may serve as a convenient intermediate step in an indirect method but a direct process can have only one step or reaction.

The possible transformation of the energy of carbon into electrical energy is the only remaining solution of the problem to be considered. Notwithstanding the time and study spent by some of the ablest investigators in attempts to obtain electrical energy from the oxidation of carbon by a "direct" process, the limitations of the problem do not seem to have been generally recognized or known. On the contrary, the most extravagant hopes have been indulged and claims asserted with, in some cases, nothing more substantial as a foundation than a cherished notion or theory.

In order to limit the scope of this article and avoid unnecessary argumentation, I shall confine my statements to pure carbon alone, admitting that they may not apply to compounds of carbon with hydrogen or other elements. Certain facts of common knowledge, it is here assumed, will be admitted without argument. These facts or assumptions may be stated as follows:

1. Galvanic or electro-chemical action is the only known process by which chemical energy has been converted without intermediate transformations into electrical energy, and is the only process by which it is expected to obtain electrical energy from carbon without a preliminary transformation into heat.

2. Galvanic or electro-chemical action can not take place without an electrolyte or conducting compound, which undergoes chemical change at its terminals.

3. Electro-chemical change takes place only at the terminals of an electrolyte, that is, at the two bounding surfaces through which an electric current is entering and leaving the electrolyte.

4. Electro-chemical action cannot take place at a single terminal only of an electrolyte.

5. Electro-chemical action always results in the separation of an electro-negative constituent from the electrolyte at one terminal and an electro-positive constituent at the other terminal. This statement does not mean that the separated constituents are necessarily liberated or set free. They may be liberated or they may be transferred to another combination, but they are always separated chemically out of the electrolyte.

6. The electro-chemical or galvanic oxidation or combination of a chemical element can occur only by the element combining with a constituent of the electrolyte.

These facts being assumed as admitted, it is evident that the "direct" combination of carbon and oxygen or of any two chemical elements cannot result in electro-chemical action or evolve electrical energy, and that the galvanic or electro-chemical oxidation of any electro-positive substance must always be accomplished by oxygen or some other electro-negative substance *derived from a previously existing compound.* In other words, galvanic action by direct chemical union is impossible, such action being merely combustion and evolving energy only as heat or light.

Although the chemical change of a galvanic reaction is necessarily indirect, or one of substitution, the transformation of the energy from chemical to electrical in galvanic action is always direct, the energy not appearing in any intermediary form. But an electro-chemical transformation of chemical into electrical energy cannot include other preceding or succeeding reactions. The electrolyte must act directly on the carbon or other body, whose oxidation supplies the energy. If the energy of the carbon is by a preliminary process first transferred to another body, which subsequently undergoes galvanic oxidation, the process of transformation is no longer direct. Likewise, if the oxygen or other electro-negative element, with which the carbon is to combine, must by a preceding chemical reaction be brought into chemical union in the form of an electrolyte before the galvanic action can take place, the process is again indirect, requiring a transfer of energy to or from the oxygen prior to the galvanic transformation.

Indirect processes of the kind, in which the energy of carbon is first transferred to another element and afterwards oxidized by galvanic action, are well known. All ordinary primary batteries consuming zinc, iron or other metals not found in the native state, merely evolve indirectly by galvanic action a part of the energy transferred to the zinc or other metal from carbon in the reducing furnace, together with some energy absorbed from the furnace in the form of heat and some energy originally stored in the ore of the metal.

In any economical process, direct or indirect, of obtaining energy from carbon, whether as heat, electrical energy or any other form, the carbon must ultimately be rejected as an oxide. There are two reasons for this. A sufficient reason is that no other known substance in combining with carbon directly or indirectly evolves more than about one-fifth of the energy evolved by the combination of carbon and oxygen. Any process that could not, even with perfect efficiency, evolve from the carbon more than 20 per cent. of the energy obtainable by ordinary combustion, could never compete with a heat engine, even if the process were not otherwise prohibitively expensive and difficult. Another reason of less theoretical, but of equal practical importance, is that oxygen is the only known substance that evolves energy in combining with carbon, which is at the same time cheap enough to be thrown away in unlimited quantities or in quantities remotely approaching those which would be required to replace ordinary combustion. It may be added that a comparison of the economy and efficiency of a combustion process and a galvanic process could be of no value, if one process rejects as a final residuum only oxygen, which costs nothing and is everywhere available without transportation or handling, while the other process rejects other elements, the cost of which with their necessary handling and transportation cannot be even estimated until we know the possible extent to which they will be employed.

In order to obtain electrical energy from carbon on a large scale or with economy on any scale, either directly or indirectly by galvanic action, the carbon must be rejected as an oxide and the oxygen must be derived from a previously existing oxide. This determines broadly certain limits, beyond which we cannot go in the solution of this problem.

Action of Gases on India Rubber.

Some interesting observations which seem to have been considered worthy of presentation before such an august body as the French Academy by Dr. d'Arsonval, showed that if pieces of caoutchouc tubing are placed in gaseous carbonic acid at pressures of 1 to 50 atmospheres, the material increases to ten or twelve times its original volume through absorption of the gas. Moreover, both carbonic acid gas and oxygen pass through rubber. This explains why pneumatic tires of bicycles deflate gradually. After the tire has been repeatedly pumped up, it will deflate less rapidly, as it will then contain almost nothing but nitrogen, which gas does not pass through rubber. He suggests inflating tires with nitrogen if they are to remain inflated for a long time.

An Electric Pantagraph.

BY LIEUT. F. JARVIS PATTEN.

IN my Laboratory Notes published in the ELECTRICAL WORLD in 1893 I showed a novel motor system of the rotary field type driven, however, by a direct current so applied to a Gramme ring as to produce a rotating magnetic field and so carry a closed coil armature in synchronous rotation with the field. This motor system, identical with the system of circuits shown in Fig. 3 of this

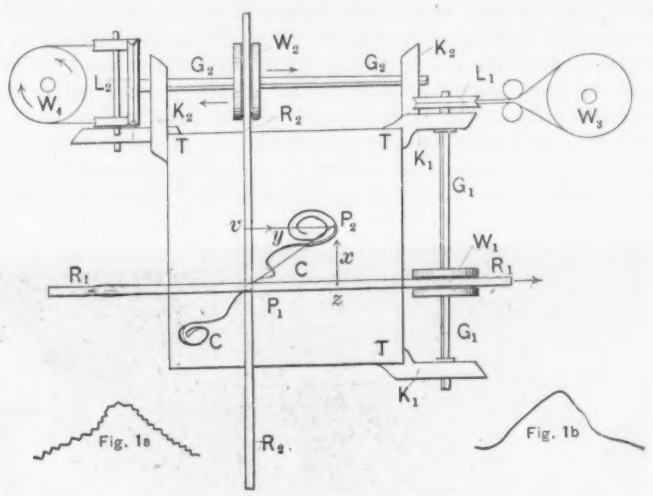


FIG. 1.—ELECTRIC PANTAGRAPH.

article, was illustrated a little differently in the article referred to, and no special application of the system was shown.

Since that time I have found numerous useful applications of said motor system, among which a novel and interesting one is the electric pantagraph. Mechanical pantagraph systems for reproducing drawings on the same or different scale are fairly operative contrivances, but seldom are they either very accurate or satisfactory. This fact is due to the lost motion of the mechanism which will invariably work loose at the joints in time, and this defect invariably destroys the accuracy of the movement. It was to avoid these defects of the mechanical pantagraph that I looked for an electrical solution of the problem, and endeavored to find a solution that would not only be free from the errors referred to but would give a true curve—that is to say, not a curve made up of step-by-step movements, as in Fig. 1a, but a true continuous curve like that shown in Fig. 1b.

I have seen nothing like an attempt to do this by an electrical device except the Gray telautograph, which is to all intents and purposes an electric pantagraph system reproducing handwriting or sketches at a distance with surprising accuracy and clearness, but the lines if examined with a glass will be seen to consist of a succession of steps on the horizontal and vertical step-by-step components of the curve as described, as in Fig. 1a. The system I have contrived gives a smooth curve, as in Fig. 1b. The system is comparatively simple and will be readily understood from the description of the figures which, to avoid confusion, are not made in extreme detail

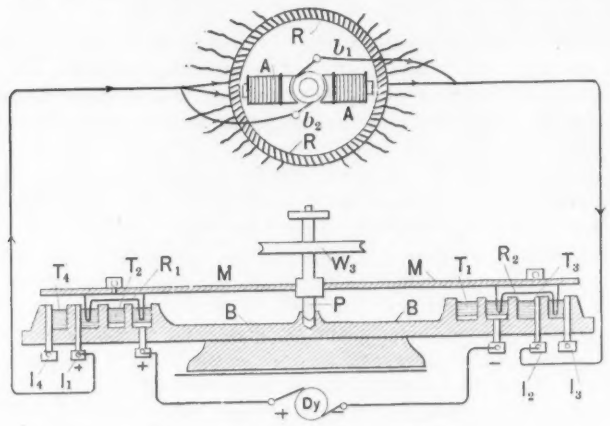


FIG. 2.—ELECTRIC PANTAGRAPH.

The square *T*, *T*, Fig. 1, indicates a plane table or board on which the design to be reproduced is fastened, and the curves P_1, P_2, represents some line of the drawing or sketch it is desired to reproduce at a distance—not telegraphically—but upon another table or in a different part of the building and to any scale desired, either the same as the drawing or larger or smaller.

The essential requirements for any such work is to first analyze any line or curve into its horizontal and vertical components, and transmit them separately, then recombine them to reproduce the line or curve on the other board. To do the first step the board is provided with two metal rulers, R_1 and R_2, rigidly connected at right angles to each other at the point P_1 where the stylus or tracing point passes down through both.

The rulers are free to move in a horizontal plane parallel to the board and near its surface, so that the tracing point, P_2, may be readily and easily moved to any point on the board, thus going over an entire drawing. This movement must be approximately frictionless and is provided for in the following way: Each ruler moves freely in the direction of its length on two wheels—only one of which is shown for each ruler, to avoid making the drawing too complicated. The wheel, W_1, for the ruler, R_1, and the wheel, W_2, for the ruler, R_2, are both shown in plan; each ruler has another one at its other free end.

These wheels revolve as their respective rulers move, say R_1 to the right or left, being geared to the ruler underneath, and the wheel W_2 turns fast or slow, backward or forward, as the ruler R_2 moves up or down in the direction of its length. Thus we see each wheel translates into rotary motion the lengthwise movements of its ruler —both with respect to direction and to speed or rate of motion.

It remains with respect to these wheels to explain that they are also perfectly free to slide along their respective spindles or guides, G_1 and G_2, whenever the ruler is moved sidewise or has a sidewise component of motion impressed by the movement of the other ruler. Thus to explain, if the point P_1 is moved straight away to the right, the ruler R_1 would turn its wheel W_1, but the ruler R_2, having only a sidewise motion, would not turn its wheel, W_2, but would simply slide it along its guide, G_2, without rotating the wheel at all. Likewise, if the point P_1 is moved straight up or down, wheel W_2 by turning would record this motion, but wheel W_1 would not revolve, but slide along its guide, G_1. It is now plain to see how the two wheels each translate the component co-ordinates of motion up or down, right or left, into corresponding representative values of rotary motion.

Thus to illustrate in further detail, let the point P_1 move to P_2 along the diagonal line P_1, P_2; then ruler R_1 would move to the right a distance P_1 to z, and ruler R_2 would move up a distance P_1 to v, and the two wheels would make revolutions proportionate to the ordinates x and y in the same time. It would evidently make no difference in the result if the point P_1 followed the curve to P_2, except that the motions of the wheels would be a little more complex and variable, both in speed and direction.

We have then here a system of analyzing the motion of the point P_1 into its component co-ordinates, x and y, no matter how complex

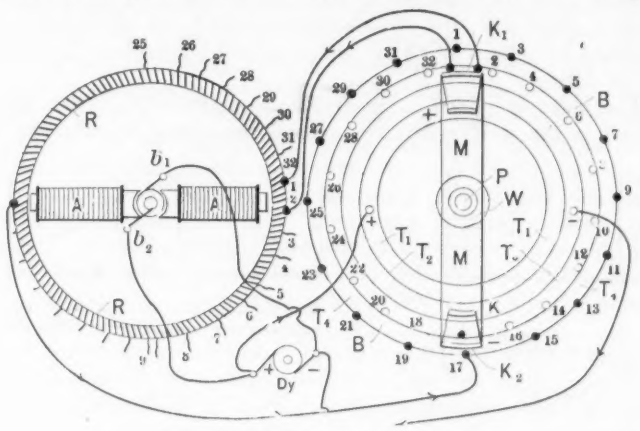


FIG. 3.—ELECTRIC PANTAGRAPH.

the motion, and translating these components of motion each into a separate and characteristic rotary movement which, by the way, is continuous and not a step-by-step movement. So much for the analysis. The next step is to recombine or synthesize these movements so as to cause another ruler system to follow the movements of the point P_1 and reproduce the curve.

This is accomplished in a simple way by the liquid commutator and

motor system referred to in the first paragraph of this article, which I have found capable of doing a great variety of very interesting tricks—reproducing and imitating the most complex forms of motion. This part of the system is shown in Figs. 2 and 3, the former a general plan or diagram of circuits of the motor and commutator, and the latter a diagram of the motor and a sectional elevation of the commutator. *B B*, Figs. 2 and 3, represents a hard rubber base having four circular troughs, T_1, T_2, T_3, T_4. These are nearly filled with mercury, and the two inner ones, T_1 and T_2, are made the positive and negative terminals of the dynamo circuit respectively. The two outer ones have pins which are really commutator segments, I_1, I_2, I_3, I_4, arranged at intervals around the circumferences of the troughs—say, 24 or 32 in all, numbered in Fig. 3 from 1 to 32. An arm, *M*, carried on a spindle carries two conducting bridge pieces made in the form of knife edges, indicated as K_1 and K_2 in Figs. 2 and 3.

As these knife edges revolve they pass the pins and convey the current through different wires to different points of the motor field ring, *R*, and determine the position of its polar line or axis which the revolving armature *A, A*, follows with great power and thus accurately duplicates or reproduces the motion of the revolving arm, *M*, of the liquid commutator. Thus, no matter what motion, however erratic, fast or slow, backward or forward, we give to the arm, *M*, of the liquid commutator, the armature, *A, A*, of the rotary field motor will accurately follow and reproduce this motion with any desired power.

Here, then, we have a means of turning the motion of the wheels actuated by the rulers into an exactly reproduced but powerful movement, being identical with that of the ruler-actuated wheels both in direction of motion and rate of speed.

The entire pantagraph system will now be understood. Referring again to Fig. 1, we see each ruler through a system of pulleys or gears drives its own liquid commutator fast or slow, forward or backward, according to its motion; and this motion is reproduced by a pair of powerful motors, each following accurately the movement of its own liquid commutator. The parts W_3, W_4, Fig. 1, represent the commutators driven by the motion of each ruler. We have now only to imagine the armatures of the power motors driving long screws placed in a horizontal plane and working at right angles to each other through a common nut or carriage; then a point on this carriage carrying a pencil or stylus will accurately trace on a second table the movement of the point P_1 on the pantagraph table and reproduce the picture traced. Numerous applications of this motion-reproducing system have been made.

Electric Rail-Welding at Buffalo.

The Lorain Steel Company, of Lorain, O., has one of its electric rail-welding plants in operation in Buffalo, where 50 miles of track belonging to the International Traction Company is being welded. Of the track being thus treated about 25 miles is of the 60-foot 9-inch rail, the ends being left blank for the joint. The contract includes about 7500 joints, of which 2000 have been made up to date.

The plant in operation in Buffalo consists of five cars, one of which is the welder car, the second the rotary transformer car,

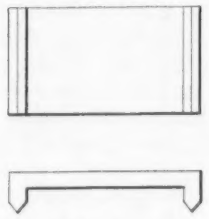


FIG. 1.

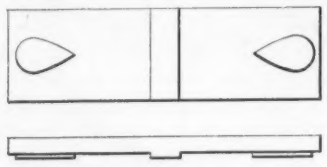


FIG. 2.

and the third the booster and motor car. The other cars are the sand blast car, which goes in advance of this train and prepares the joint for welding, while the fifth car is equipped with a motor and emery wheels for dressing any inequalities of the joints. These cars are moved over the railway line in the same manner as a trolley car, by power taken from the trolley line. The current for operating the welding machine is also taken from the trolley line, and the various connections are shown in the accompanying diagram.

The secondary of the welding transformer consists of one turn of copper, the terminals of this secondary being the clamps that grip the weld. A rheostat, shown in the diagram, enables an attendant to raise the voltage of the machine by any amount desired, to compensate for any lack of line voltage.

About five years ago the West End Street Railroad Company of Boston made some extensive experiments in the electrical welding of street railway tracks, various methods being employed; by one the ends of the rails were butt welded, by another plates (like Fig. 1) were welded against both sides of the web of the rails. The original contact between the plates and the rail was along the sharp edge at each end of the plate and was made very small to localize the heating. As the metal of the plate softened it was forced against the rail, crushing down the projection of the plate until the final contact area was considerable. Then the pressure was removed and the joint allowed to cool naturally.

The Lorain Steel Company employs a form of plate to weld to the sides of the rail web shown in Fig. 2. The original contact with the rail is made by the small oblong boss near each end of the plate and

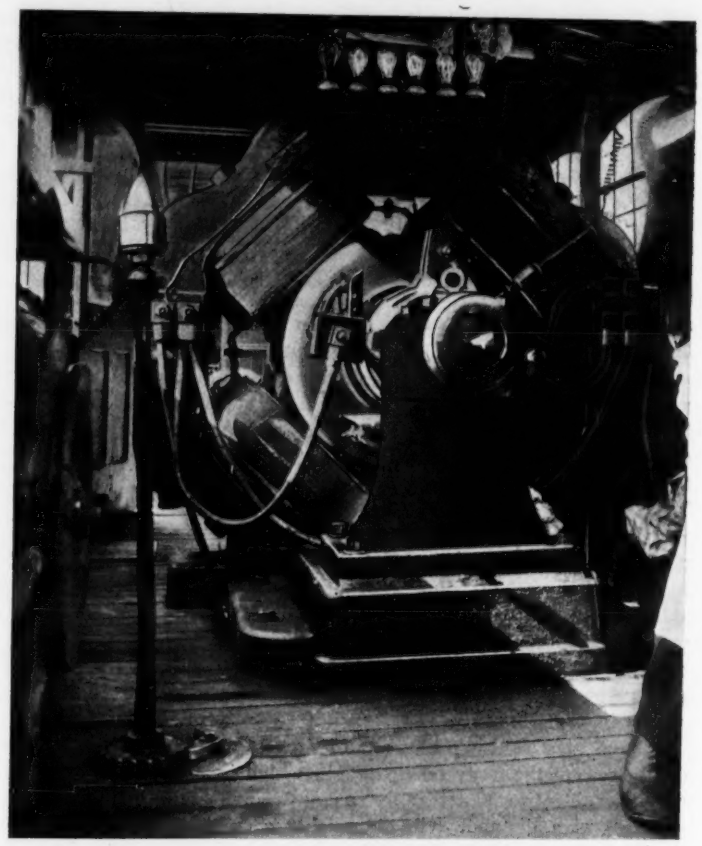


FIG. 3.—ROTARY TRANSFORMER.

the raised strip across the middle of the plate, which is opposite the two rail ends. These projections are about one-eighth of an inch high. The area of the boss at each end is about three and one-fourth (3¼) square inches, and that at the middle is slightly greater.

One great difference between the two methods of welding, the earlier of which was unsuccessful and the later of which appears to be quite successful, lies in the area of the initial contact between the welding plates and the rail web. In the old method this contact was very small, consequently the metal at the contact was heated to a very high temperature and usually burned, while in the later method the temperature is not as great and the burning of the steel is avoided. Every blacksmith knows that if two pieces of steel are heated to a welding temperature and pressed together and allowed to cool without further working, the weld, if there is any will be brittle, but if the metal is hammered as it cools, the steel will be fine grained and tough at the weld as elsewhere, unless it has been burned.

The Lorain Steel Company maintains a very high pressure upon the welded plates by means of a hydraulic clamp, until the joint is cool. This pressure runs as high as thirty-five tons. The small projections upon the surface of the plates are flattened out and the area of the weld is usually slightly greater than the original area of these raised surfaces.

The improvements over the old method consist in the making the weld at a temperature that is not high enough to burn the steel and in working the steel under great pressure while the weld is cooling, which prevents the occurrence of a coarse crystalline structure in the metal about the weld.

On unpaved streets where new track is laid, the welding can be done before or after paving, open spaces about 2x2 feet being left at the point of the joint in order that the welder can be placed to the joint without difficulty. Where an old track is being welded spaces of similar size can easily be made in the pavement and closed

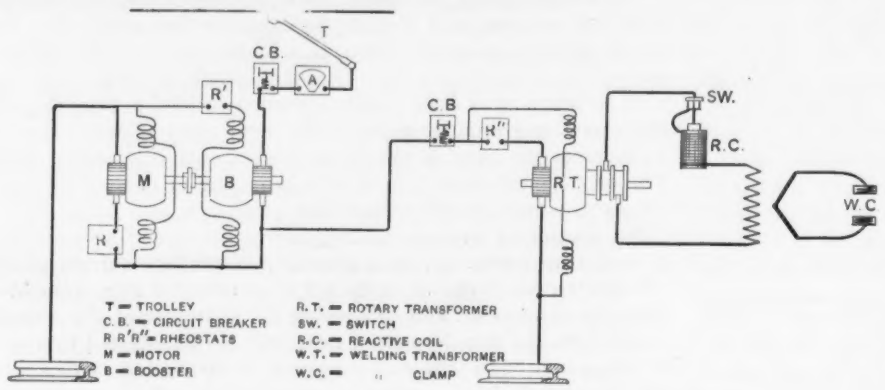


FIG. 4.—DIAGRAM OF CONNECTIONS OF RAIL WELDER.

up after the weld. The plant is quiet in its operation, and there is little or no disturbance to the vicinity of its labor.

The weld is made from a bar 1x3 inches and 18 inches long and bossed. Three welds are made at each joint. After the bars of metal are placed in position the welding train moves forward and the welder clasps one bar of metal to each side of the rail web. Pressure on the clamps is run up to about 1400 pounds and then the current is applied. The centre weld is made first, each weld being made from the boss on the bars, and as this boss concentrates the heat directly at the point of welding, the head of the rail is only slightly heated, thus avoiding any likelihood of softening and annealing the rail.

It has been found that the process of making the weld from bosses on the bars is an improvement over flat bar welding, as the relatively cold portions of the bar about the boss have a tendency of confining the more plastic metal, and this, with the heavy pres-

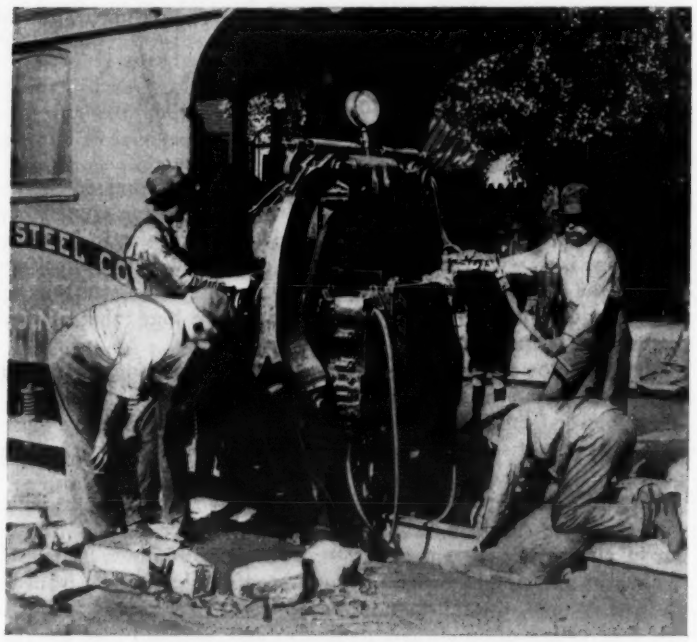


FIG. 5.—WELDER AT WORK.

sure that is applied when the welding heat has been reached, the current turned off and the artificial means of cooling applied, prevents, as stated before, detrimental effects, such as crystallization in coarse form. The fact that the weld is cooled under great pressure, applied by means of an hydraulic jack on top of the welder, strengthens the joint materially.

After the centre weld is made, the ends of the bar are similarly treated. The welding of a joint occupies about 15 minutes, during which the current is on but a portion of the time. The coupling between the welder car and the transformer car is so arranged that the welder car can move the necessary few inches in making a weld without disturbing the position of the other cars, a fact of considerable convenience.

The welding transformer primary is run at 300 volts, while from 5 to 7 volts is used at the welding clamp terminals. The welding current runs as high as 25,000 amperes. The completion of the weld is recognized by observation, principally of the color of the hot metal.

Electric Asepsis.

Three United States patents relating to electrotherapeutics were issued July 4 to Prof. H. G. O'Neill. One of these relates to a method of controlling high-tension currents; another is on an electric vacuum electrode for therapeutic purposes, and the third covers electrotherapeutic apparatus. All three patents refer to a new application of electricity whereby, it is claimed, wounds, suppurating and other diseased surfaces, are rendered aseptic.

The principle claimed is the creation of a local atmosphere of nascent ozone by means of electricity. The process consists in the application of high tension currents, preferably of high efficiency to the parts affected, through a glass vacuum electrode. It is claimed that these currents, entering the vacuum chamber, become attenuated, and passing through the contact surface of the electrode, leap through the space between it and the seat of disease, then ground through space. The appearance of the discharge is described as resembling a shower of minute downy feathers, its effect on the most sensitive surface being devoid of all shock or unpleasant physiological sensation. The density of the discharge may be regulated at will, as may also its area, ranging from one-quarter of an inch to several square feet, according to the electrode employed and the area of the disease involved. It is stated that a high potential must be employed owing to the necessarily great power to disrupt the molecules of air, and that the object of the glass vacuum electrode is to attenuate and spread out the currents in such a manner as to produce the soft tempered effect referred to, the decomposing action being nevertheless very powerful. Thus not only the air surrounding, but also that occluded within the diseased surface, is decomposed as well as the oxygen contained in the purulent or other matter present, the oxygen molecules being resolved into atoms and reconstructed into a new group, as ozone. By this process the ozone is produced in situ and being employed in a nascent form, follows the law of most gaseous bodies, is in this condition most energetic.

Numerous experiments in the laboratory have proved to the satisfaction of the inventor that ozone thus produced is fatal to all germ life, the bacillus and spores of anthrax, the largest and most resistant of pathogenic organisms being annihilated as effectively as the lesser resistant germs. This total annihilation of germ life is not revealed alone by the microscope, but also by the failure to produce cultures under the most favorable circumstances.

It is claimed that by this system a wound may be rendered aseptic throughout its entire tract, or a diseased condition at any depth, due to the penetrating power of the current and its decomposing action on the oxygen necessarily present, thus affording a perfect method for internal asepsis for which there exists no other substitute.

It is stated that the diseased surface will always be affected owing to the presence of moisture there, for the reason that the current preferably follows the path of least resistance while spreading to some extent all over the body.

A case is cited of a patient having a well defined case of phthisis, with all the symptoms of night sweats, high fever, loss of appetite, insomnia, coughing and all other manifestations of the disease, and examinations disclosed colonies of tubercal bacilli. After a week's treatment, it is stated that the temperature became normal, there were no night sweats, the appetitie was good, the patient slept well, the coughing was almost gone, very few bacilli were in the sputum and three pounds of flesh were gained—with such a change in his

general physical condition as makes him feel and appear to all like a new man. In addition, complications of catarrh of the stomach likewise yielded to the influence of the treatment.

It is also claimed that electric asepsis stimulates the local reparative processes, invigorates the entire system and has an antalgic influence and soothes the nerves. Its employment is indicated in catarrhs of the mucous membranes and for the cure of diphtheria. The necessary effects can be obtained, having an electric source of suitable character, by employing vacuum electrodes of glass having a single electrical communication.

Electrical Measuring Instruments.

Prof. W. E. Ayrton, in a paper read at the recent Engineering Conference of the English Institution of Civil Engineers, gave some of the more important considerations involved in the manufacture of electrical measuring instruments. A few years ago, he said, copper of 98 per cent. conductivity (Matthiessen's standard) was considered good, now it is stated that copper of 105 per cent. conductivity can be obtained commercially from Mouchel of France. The great increase in the electric conductivity has been attributed to greater density of the material; but there seems to be considerable doubt about this, and it is desirable to try whether a still further electric improvement, possibly even a relatively large one, might not be produced by using much greater care in removing the last traces of impurities. It is also important to find out exactly how the variation of resistance with temperature increases with increase in the electrical purity.

Soft iron for needles of electrical instruments should have small remanent magnetism and small coercive force, while both these qualities should be large in steel for permanent magnets. A large magnetic improvement has been effected in commercial soft iron during the last few years, and even steel can not be purchased in ingots having a far smaller coercive force than the so-called "soft" iron practically employed for electric apparatus six or seven years ago; and, by constructing the meter so that the magnetic induction is kept low, soft-iron instruments may be used for measuring alternating currents and pressures with fair accuracy. It should be remembered, however, that although the number of turns and the maximum scale reading may correspond with a number of ampere-turns which produce only a small induction with a sine or a flat wave, such instruments may read wrongly if the wave be peaked. A satisfactory compensation for variation in the frequency is effected by shunting the instrument with a self-induction, and experiments should be made to devise some such device to compensate for the wave having a peak.

The manufacture of steel magnets has much improved during the past few years, as indicated by the following results obtained from tests on steel magnetized with a force exceeding 200:

	Residual Magnetism.	Coercive Force.
1885. Oil-hardened steel tested by Dr. J. Hopkinson.....	11,300	12
1893. Glass-hard pianoforte wire tested by Professor Ewing.	9,500	45
1898. Molybdenum steel tested by Madame Curie.....	——	85

This marked increase in the coercive force, which is of great importance in preserving the constancy of permanent magnet types of measuring instruments, has been brought about partly by improvement in the composition of the material, and partly by greater experience having been gained regarding the proper way of hardening magnets. Still greater improvement may certainly be anticipated.

In instruments employing a spring control, and in which, for magnetic reasons, steel cannot be used, phosphor-bronze is the best elastic metal, but it is far excelled by quartz as regards the absence of subpermanent set. A really satisfactory method of coating quartz with even a metallic layer of sufficient conductance to serve as the flexible electrode for an electrostatic voltmeter using a spring control is very desirable, but better still, some metallic alloy possessing the mechanical properties of quartz is well worth seeking.

Alloys possessing higher and higher resistivities and smaller and smaller temperature coefficients are being constantly brought to notice, but no one seems to be seeking for a substance with a small temperature coefficient and a small resistivity, although that is the kind of substance that is needed for many purposes, as, for example, to wind voltmeter coils with and the bobbins of moving coil instruments used with a shunt for the measurement of large currents.

Ammeters and voltmeters depending on the action of one coil on another without iron generally use a working field of about 50. Therefore, since the field on a central station switchboard often exceeds 20, the disturbance may be very great. Indeed the error arising from the current in the leads alone of such an instrument may be serious. The importance of using copper of much higher conductivity than at present obtainable, so as to employ many more convolutions of wire without increasing either the volume or the resistance of a coil, is here manifest. Some soft-iron needle instruments have also fields not exceeding about 70, and are, therefore, quite useless for central station work, unless protected in special ways with soft-iron magnetic shields.

The field in which the coil of some moving-coil instruments turn is as high as 1200, and it might be expected that small stray fields would produce no error. But, as a matter of fact, the iron pole-pieces, and especially the iron core, concentrate the stray field on the coil; so that a stray field of only 0.5 when parallel to the field of the instrument may produce an error of 0.4 per cent., or nearly ten times as great as the ratio of the fields alone would lead one to expect. The employment, however, of an astatic pair of narrow coils without an iron core greatly reduces this error.

For measuring large alternating currents it is desirable to employ a small transformer giving a maximum secondary current of some 10 amperes, which can be easily led to an ammeter at a safe distance from the main cable, and by keeping the resistance of the secondary circuit low, the transformation ratio will not be affected by changes of frequency. The best way at present of measuring small alternating currents is by means of an electrostatic voltmeter shunting a non-inductive resistance.

Electrostatic voltmeters have practically no errors due to stray magnetic fields, unless they are rapidly alternating. In that case, unless the needle and inductors be properly subdivided, eddy currents may be induced and a disturbing force introduced. The error due to impedance is practically zero, as the capacity of a dead-beat electrostatic voltmeter with a 12-inch pointer need not exceed about thirty-millionths of a microfarad. Pivot-friction and brush-discharge between the needle and inductors introduce the greatest troubles, and it is difficult to obtain as much damping as is desirable. Coating the inductors with mica, enamel, etc., greatly reduces sparking between them and the needle, but not the brush-discharge with an alternating potential difference, and is, therefore, of little practical use. A better method of stopping the brush-discharge than by immersing the whole instrument in oil is much needed.

Direct-reading ohm-meters, measuring up to 50 megohms, are now obtainable, but apparatus is also needed to enable the insulation of an electric light cable to be tested where laid. At present cable is often supplied which, although possessing only a fraction of the specified insulation, is passed because suitable testing apparatus can be used only in a laboratory.

Electrical Standardization—VI.*

RATING.

Both electrical and mechanical power should be expressed in kilowatts, except when otherwise specified. Alternating-current apparatus should be rated in kilowatts on the basis of non-inductive condition; i. e., with the current in phase with the terminal voltage.

Thus the electric power generated by an alternating-current apparatus equals its rating only at non-inductive load, that is when the current is in phase with the terminal voltage.

Apparent power should be expressed in kilovolt-amperes as distinguished from real power in kilowatts.

If a power-factor other than 100 per cent. is specified, the rating should be expressed in kilovolt-amperes and power-factor, at full load.

The full-load current of an electric generator is that current which with the rated full-load terminal voltage gives the rated kilowatts, but in alternating-current apparatus only at non-inductive load.

Thus in machines in which the full-load voltage differs from the no-load voltage, the full-load current should refer to the former.

If P = rating of an electric generator and E = full-load terminal voltage, the full-load current is:

$I = \frac{P}{E}$ in a continuous-current machine or single phase-alternator.

$I = \frac{P}{E\sqrt{3}}$ in a three-phase alternator.

*Report of the Institute Committee on Standardization of Generators, Motors and Transformers.

$I = \frac{P}{2E}$ in a quarter-phase alternator.

Constant-current machines, such as series arc-light generators, should be rated in kilowatts based on terminal volts and amperes at full load.

The rating of a fuse or circuit breaker should be the current-strength at which it will open the circuit, and not the working-current strength.

CLASSIFICATION OF VOLTAGES AND FREQUENCIES.

In direct-current, low-tension generators, the following average terminal voltages are in general use and are recommended:

125 volts. 250 volts. 550 volts.

In direct-current, and alternating-current, low-pressure circuits, the following average terminal voltages are in general use and are recommended:

110 volts. 220 volts.

In direct-current power circuits, for railway and other service, 500 volts may be considered as standard.

In alternating-current, high-pressure circuits at the receiving end, the following pressures are in general use, and are recommended:

1000 volts. 2000 volts. 3000 volts. 6000 volts.
10,000 volts. 15,000 volts. 20,000 volts.

In alternating-current, high-pressure generators, or generating systems the following terminal voltages are in general use and are recommended:

1150 volts. 2300 volts. 3450 volts.

These pressures allow of a maximum drop in transmission of 15 per cent. of the pressure at the receiving end. If the drop required is greater than 15 per cent. the generator should be considered as special.

In alternating-current circuits, the following approximate frequencies are recommended as desirable:

25 ∽ or 30∽ 40 ∽ 60 ∽ 120 ∽

These frequencies are already in extensive use and it is deemed advisable to adhere to them as closely as possible.

OVERLOAD CAPACITIES.

All guarantees on heating, regulation, sparking, etc., should apply to the rated load, except where expressly specified otherwise, and in alternating-current apparatus to the current in phase with the terminal e. m. f., except where a phase displacement is inherent in the apparatus.

All apparatus should be able to carry a reasonable overload without self-destruction by heating, sparking, mechanical weakness, etc., and with an increase of temperature elevation not exceeding 15° C., above those specified for full loads. See Secs. 25 to 31.

Overload guarantees should refer to normal conditions of operation regarding speed, frequency, voltage, etc., and to non-inductive conditions in alternating apparatus, except where a phase displacement is inherent in the apparatus.

The following overload capacities are recommended:

1. In direct-current generators and alternating-current generators; 25 per cent. for one-half hour.

2. In direct-current motors and synchronous motors, 25 per cent. for one-half hour, 50 per cent. for one minute, except in railway motors and other apparatus intended for intermittent service.

3. Induction motors. 25 per cent. for one-half hour, 50 per cent. for one minute.

4. Synchronous converters. 50 per cent. for one-half hour.

5. Transformers. 25 per cent. for one-half hour. Except in transformers connected to apparatus for which a different overload is guaranteed, in which case the same guarantees shall apply for the transformers as for the apparatus connected thereto.

6. Exciters of alternators and other synchronous machines. 10 per cent more overload than is required for the excitation of the synchronous machine at its guaranteed overload, and for the same period of time.

CURRENT NEWS AND NOTES.

CANADA AND THE PACIFIC CABLE.—The bill providing for the payment by Canada of a proportionate share of the cost of construction of the proposed Pacific cable, passed the Canadian Senate on Aug. 2, thus becoming a law.

**The frequency of 120 ∽ may be considered as covering the already existing commercial frequencies between 120 ∽ and 140 ∽ and the frequency of 60 ∽ as covering the already existing commercial frequencies between 60 ∽ and 70 ∽.

SOUTHERN POWER TRANSMISSION.—The utilization of southern water powers electrically is having a noticeable effect on the manufacturing industries in that section. Columbia, S. C., is a notable instance. The largest cotton mill in the south is now to be established there, and the capital of $1,500,000 was all subscribed in a single day. Ground is now being broken for the work, and the factory will be built and equipped forthwith.

NEW ARTIFICIAL FUEL.—Berlin journalists are busy pursuing the reported invention of artificial coal by one Herr Montag, of Mannheim. His latest statement declares that from the point of hygiene his artificial coal is preferable to ordinary coal, as it does not develop poisonous gases, creates but little soot, and leaves no slate and but a small amount of ash, the latter resembling wood or cigar ash; further, there is no danger of explosion or conflagration. The fuel is composed of 92.94 per cent. of ordinary earth, and 6 to 8 per cent. of chemical ingredients, and is cheaper and better than coal. Any piece of land, even if unfit for agriculture, can be used to produce this fuel. The cost of the necessary plant is very low, the price of a machine being only $3750. Patents for the invention have been taken out in seventeen countries.

BATTERY DEPOLARIZATION SOLUTIONS.—A patent was granted Aug. 1 to Gustav Platner, of Witzenhausen, Germany, for a new primary battery depolarization solution composed of chlorates combined with metallic salts capable of readily forming basic salts and disengaging acids or halogens. Among the chemical compounds named are salts of iron, such as chloride sulphate of iron and iron and chromium salts. For example, in the case of a carbon cylinder battery, the cylinder containing a dry mixture of sulphate of iron, chlorate of potash or sodium and peroxide of manganese tightly packed together, with zinc in a solution of chloride of ammonium, an e. m. f. of 1.8 to 1.9 volts is obtained. The chemical action gives rise to a basic iron or chromium salt, while the sulphuric acid decomposes the chloric acid, which at once separates into chlorine or oxygen. This action, however, takes place so slowly that the cell would remain constant for a very long period.

FRANKLIN STATUE FOR PARIS.—The citizens of Philadelphia will present to the City of Paris a statue of Benjamin Franklin for the exposition next year. When the Franklin statue, recently presented to the city by Justus C. Strawbridge, was unveiled, United States District Attorney Beck, who delivered the oration, suggested that the citizens of the United States ought to present to the French people a statue of the great philosopher, in return for Bartholdi's Statue of Liberty, given to this country. The suggestion has taken shape and Mayor Ashbridge has appointed a committee of twenty-seven prominent Philadelphians to carry out the idea. It is proposed to raise the money and have the work begun as soon as possible, so that the statue can be shipped to Paris in time to unveil it before the exposition closes. It is intended to place the statue in Passy, where Franklin resided when he was Minister to France over 100 years ago. Passy, then a suburb, is now in the centre of the exposition grounds. The statue will be a replica of the one in Philadelphia, which cost $14,000, and stands in front of the post office.

MOTOR SPEED REGULATION.—A patent was granted Aug. 1 to Granville T. Woods, of New York, for a motor system adaptable for variable speeds, which resembles somewhat the Ward Leonard system of motor control. As illustrated, the current from a constant potential source drives a motor, which in turn drives a generator, the motor having a constant field and the generator a variable field, and consequently variable e. m. f.; finally, the current from the generator actuates the motor whose speed is to be controlled. In addition, however, to the e. m. f. furnished by the motor-generator, the e. m. f. of the source may be used in circuit, a switching arrangement being described for this purpose. One method described is to start the working motor from the variable potential generator, the e. m. f. of which may be gradually increased until it exceeds that of the constant potential source; then supplying the working motor from both e. m. fs. in parallel; then opening the circuit from the variable potential source, withdrawing the variable e. m. f.; then throwing the second e. m. f. into series and building up the working e. m. f. from the variable potential source until the desired total e. m. f. is produced. That is to say, the motor is coupled up first to the variable generator and then its e. m. f. put in series with that of the constant potential source.

SOUTHERN WATER POWER SOLD.—The Columbia Canal, at Columbia, S. C., with 16,000 developed horse-power, and the 7000-hp at Saluda, have been purchased from New England owners for $800,000 by W. B. Smith Whaley, of Columbia, and J. L. Coker, of Darlington, S. C. Mr. Coker owns a paper mill, which is to be moved there. Mr. Whaley is president of corporations owning three cotton mills in Columbia. It is understood the mill corporations and the canal corporation will be consolidated into one company, with $3,000,000 capital. Mr. John E. Searles is taking an active interest in cotton mills, and he is believed to be backing the canal purchase. The electrical development of the power has already assumed considerable magnitude, and has been referred to in these columns.

MOTOR CONTROL.—A patent issued Aug. 1 to Allan H. Whiting provides for breaking the motor circuit of an electric vehicle when the brake is applied or when the current exceeds a predetermined amount, and prevents the circuit being again established except by a movement of the controller lever starting from the zero position. A switch in the motor circuit is normally held closed by a latch; when an excess of current passes, the latch is struck by the core of a solenoid and a spring opens the switch. The excess of current may be due to an overload, such current passing through one winding of the solenoid, or to the brake closing a circuit which causes a large current to pass through a second winding. In either case, the switch can only be relatched at the zero position of the controller before the vehicle can be started.

A NEW ELECTRIC MOTOR.—In a patent issued Aug. 1 to J. T. Robson, of London, an electric motor is described in which the armature rotates in one direction and the case of the frame containing the field magnets rotates in an opposite direction, both driving the motor shaft. The arrangement, in fact, consists of two electric motors, the armature of one and the set of field magnets of the second being fixed to the shaft, while the set of field magnets of the first and the armature of the second are provided with a sleeve which rotates on the shaft but in an opposite direction thereto. The two motors are connected in series, and on each end of the double are four rings on the shaft insulated from each other; brushes on two of the rings at each end connect the circuit with the armature coils, and the other two brushes connect with the magnet coils. The gearing of the two revolvable parts may be such that both will revolve the same shaft, or revolve separate shafts. As applied to electric railway cars or automobiles, no special differential gearing is thus needed for enabling the vehicle to turn a corner, as the armature of the one motor and the field magnets of the other automatically slow down to a given speed while allowing the remaining motor and field magnets to run together at full or any required speed.

SYSTEMS OF ELECTRICAL DISTRIBUTION.—On Aug. 1 two patents were granted to the late Prof. Galileo Ferraris and Prof. Ricardo Arno, of Turin, Italy, on a system of single-phase electrical distribution having the addition of a third wire for starting motors. The system is based on the use of a phase displacing apparatus consisting broadly of an inducing member with several windings, one of them being connected to a source of single-phase current; and an induced member, preferably short-circuited. This may practically be an ordinary single-phase induction motor installed where most convenient, with extra coils wound on the field at an angle with the primary coils so as to furnish an out-of-phase e. m. f. The out-of-phase e. m. f. thus produced may be combined with the single-phase e. m. f. so as to produce any desired phase relation. The third wire is run out from the phase-displacing apparatus to single-phase motors, which are thus brought up to speed as polyphase motors, after which they are run as single-phase motors. One of the patents describes an arrangement whereby but one motor of a number in circuit may be started at a time, thus limiting the amount of energy to be carried by the third wire. The arrangement for this purpose is such that at any place where a motor is installed an indicator will show whether the third wire is being used to start any of the other motors, in which case starting will be deferred until the instrument indicates that the third wire is not in use.

REGULATION OF ALTERNATING CURRENT MACHINES.—A patent containing 24 claims was issued Aug. 1 to MM. Hutin and Leblanc, having for its object the excitation of all types of alternating current machines in such a manner as to produce a proper regulation under varying conditions of load, and at the same time allow the machines to be designed in such a manner as to secure a maximum output in proportion to the weight of copper and iron employed. This is accomplished by means of an exciter so constructed and arranged that its voltage varies in such a manner as to compensate for the variations of load and inductance on the main circuit, and maintain a constant voltage at the brushes of the main machine. The exciter may also be so designed as to produce an over-compounding, if desired, and it also aids in the coupling of generators and motors in parallel and in the regulation of motors, and serves to prevent motors from taking idle current. The maximum output in proportion to the weight and copper used follows from the system now enabling a reduced air gap to be used, thus permitting the copper to be approximately equally divided between the fixed and movable parts. As described for three-phase work, the rotor of the exciter has two separate cores with windings, one winding being connected in series with the armature circuit of the generator excited, and the other in shunt. These windings are both overwound by a third separate winding which connects with a commutator, and from which a direct current goes to the field of the generator when the exciter is run, either by gearing or a synchronous motor, at the same speed as the generator if the number of poles of exciter and generator are the same. A single iron ring surrounds both exciter armatures, but the portion surrounding the shunt winding is partly cut away, with the result that the shunt field becomes saturated while the series field remains below saturation. Furthermore, to compensate for armature reaction, there is a winding about the stationary field ring which is in series with the commutator of the exciter and the field magnets of the alternator. The patent describes various other combinations as applied to single-phase generators and synchronous and asynchronous motors.

NEW TELEPHONE EXCHANGE SYSTEM.—A patent was issued Aug. 1 to Geo. L. Cragg, for a new telephone exchange system in which the manually-controlled ringing and listening keys are replaced by automatic keys operated by relay mechanism, each relay mechanism being controlled by an operator's connecting plug. The system employs mechanism which not only automatically operates the ringing keys, but also automatically operates the listening keys, a single electromagnetic appliance being employed, associated with each cord circuit, which is so organized and controlled by the switching apparatus employed in connecting subscribers for conversation that all of the various operations of the ringing and listening keys are automatically accomplished in orderly sequence. By dispensing with manually-operated keys associated with the operators' cord sets, it is obvious that the number of motions necessary to be made by the operator would be considerably reduced, the operator merely having to manipulate the answering and connecting plugs; so that, in establishing a connection, she would have to make only two motions, instead of four. In disconnecting, she would make two more, the total number of movements in the new system in connecting and disconnecting being four instead of six. Mr. Cragg suggests the possibility of still further reducing the motions to one in connection and one in disconnection, so that the total number of the operator's manipulations will be two instead of six. He suggests the feasibility of the employment of relay mechanism adapted automatically to connect a calling line with the answering end of a cord circuit, which, at the same time, will operate a signal, so that the operator would have to manipulate only a single plug in connecting and disconnecting, the answering plug being totally replaced by the relay apparatus. It is obvious that by such a system the line indicators could all be dispensed with and replaced by indicators associated with the cord circuits, a fewer number of indicators associated with the cord circuits replacing the larger number of line indicators.

NIAGARA POWER TO BE TRANSMITTED TO TORONTO.—Electric energy developed at Niagara Falls is to be transmitted to Toronto for manufacturing and lighting purposes. The authority for this statement is Wallace Nesbitt, Q. C., Canadian counsel for the Canadian Niagara Falls Power Company. Mr. Nesbitt visited Niagara Falls, N. Y., on July 31, where he had been summoned to consult with Colonel Rankine, secretary of the company, and Prof. George Forbes, F. R. S., of London, England, the well-konwn electrical engineer. At the meeting of these three gentlemen the question of the transmission of power to Toronto, Ont., was discussed, and it is understood that a decision favorable to the project was reached. Another company in which Senator Cox, of Toronto, and Mr. James Ross, of Montreal, are interested, has also opened negotiations with

the Ontario government for a franchise to develop power on the Canadian side of the falls, but Mr. Nesbitt says that his company is not afraid of the issue, for it has the capital, it has the patents and it means business. The company proposes to develop 100,000-hp, involving an expenditure of from $2,000,000 to $3,000,000. The site of the works will be opposite the monastery, and boring will be immediately begun. The power will probably be transmitted to Toronto by overhead wire, and will be developed on the Canadian side of the falls. Prof. Forbes has been the guest of Secretary Rankine, of the Canadian Niagara Power Company, during his stay at the Falls. He sails for India shortly, having been commissioned by the government there to prepare plans for the construction of works in the Madras Presidency for the development of electrical energy. These works, it is said, will be on a scale equal to those constructed by the Cataract Power Company on the American side of Niagara Falls.

ELECTRIC TRACTION IN LONDON.—A London despatch of July 28 states that the chairman of the Metropolitan Railway has announced that at the beginning of October electric traction will be installed on all the lines of the company. The newspapers unanimously applaud the change from steam power. The system is entirely underground, and the smoke and gases from the engines have always been a most objectionable feature, preventing many persons from riding on the lines.

POOR BOYS!—A recent European cable despatch affirms that "Dr. Remond, the French scientist, announces a discovery by means of which the mental processes of youth can be quickened and accelerated by an application of electricity. Remond asserts that the cultivation of the mental powers can be pushed to a far higher point by the application of an electric current than by any art of the crammer. The cerebellum which has been prepared by a course of electric shocks shows, he asserts, an immense superiority in the assimilation of learning to one in a natural state."

A TOUR AROUND THE WORLD.—Mr. W. J. Johnston, late proprietor of the ELECTRICAL WORLD, on Aug. 1, started on a tour around the world. After a visit to the Yellowstone Park, Mr. Johnston will sail on Aug. 17 from San Francisco, the first stages of his journey being the Hawaiian Islands and Japan. In the Orient, Korea, China, Manila and Java will be visited, and about six weeks passed in India. The entire trip will consume about eight months, and comprises visits to Egypt and Turkey. Mr. Johnston for some years has had in view such a journey, and has taken advantage of the opportunity afforded by his recent retirement from the journalistic field to realize it.

A BAD TROLLEY ACCIDENT.—On Sunday afternoon last, Aug. 6, a trolley car on the Shelton (Conn.) Street Railway filled with passengers jumped the track near the south end of the long high bridge over Peck's stream, about a mile and a half beyond Stratford, Conn. It ran along the heavy planking on the bridge for seventy-five feet and then toppled off, falling fifty feet to the valley below. The car turned completely over in its descent and the heavy motors drove the floor against the top and crushed many passengers. Out of 45 passengers 28 were killed. At the present writing the responsibility for the disaster has not been placed, but it is generally charged to the motorman. The motorman, who was injured, has been placed under arrest on the charge of manslaughter.

THE INTERNATIONAL AUTOMOBILE RACE RULES.—Sir David Salomons, who is the chairman of the Foreign Relations Committee of the Automobile Club of Great Britain and Ireland, has addressed to this country the following communication in regard to the proposed international automobile race: The committee of this club understands that the gentleman who instituted an international automobile cup placed in the hands of your committee the framing of the regulations affecting racing for this cup. The committee of this club does not desire for one moment to interfere with the committee of the Automobile Club de France in the framing of these rules, but it has asked me to convey to your committee the hope that the Automobile Club de France may be so good as to call a meeting of delegates of the other recognized automobile clubs in order that they may place before your committee, for consideration, representations as to provisions which might fittingly be incorporated in the rules. Possibly, in view of the fact that the cup is to be international, the committee of the Automobile Club de France may see its way to accede to this suggestion. I am also desired to state that the committee of this club trusts that the Automobile Club de France will approach the donor with a view to an alteration of one of the conditions under which it is understood he is presenting the cup—namely, that competing vehicles should be confined to those propelled by electricity and motor spirit. It is hoped that the best influence of your committee will be used to induce the donor to open the competition to all self-propelled road vehicles, irrespective of their motive power.

THE THIRD RAIL IN BROOKLYN.—In speaking of the success of the third-rail system of the Brooklyn Rapid Transit Company upon its Fifth Avenue elevated line, Mr. R. B. Brown, the chief engineer of the company, says: "The operation of the third-rail system upon the elevated structures of the company is only in its infancy. We started the experiment about a fortnight ago by running five trains over the Fifth Avenue line between Park Row and Coney Island. As far as the success of the experiment is concerned, it is assured. But the company is not in any hurry about superseding the locomotives. No new electric motors are being used as yet, and no orders for any have been placed. On the contrary, the company is using some of the regular elevated and bridge cars, simply putting into them motors that are somewhat larger and more powerful than those used upon the surface trolley cars. The brakes and controllers used thereon are also similar to those employed on the surface cars, and are principally of the Westinghouse and Sprague systems. The principal or motor car is no different in appearance from the other cars of the train. The engineers who have been taken from their locomotives and placed upon these third rail motors have readily learned their new duties and the trains are running smoothly. The trains are no larger than those generally in use, three cars besides the engine or motor still being the number used to make up a train. The electric cars will be better than the locomotives, because they will run more smoothly, and can be started and stopped more easily. I can not tell whether, or how soon, they will be tried upon other branches of the system; probably not very soon."

LETTERS TO THE EDITORS.

Lodge Wave Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—In a previous communication (printed in the ELECTRICAL WORLD AND ENGINEER July 29) I gave a sketch of a device which I had used for making the coherer respond to weaker stimuli. I have had my attention called to the fact that Marconi has recently patented a somewhat similar scheme. Whilst not wishing in any way to detract from Mr. Marconi's credit for this valuable improvement, I would like to point out, as the accompanying letter* will show, that my own work was done independently of and before any

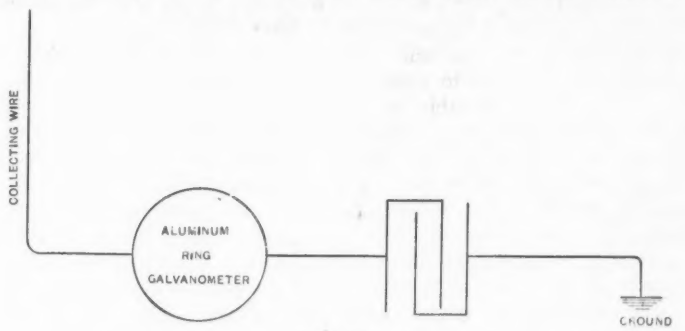


FIG. 1.

publication had been made of the method by Marconi. The device had also been described at different times in my lectures.

The chief difference between the two plans is that Marconi uses an "induction coil," presumably of the usual kind, with an iron wire core, and has a condenser in the secondary. I use a Thomson, or air should be of large cross-section, about a foot square, depending upon

*The letter referred to is as follows, the date being July 26, 1899: Dear Fessenden:—I remember your speaking to me several times during the past year about using an air transformer with the wireless telegraph, but do not know the dates, except on June 25, when I remember your calling Mr. M——'s attention to the fact that the patent should be applied for at once.

(Signed) HENRY W. FISHER,
Electrical Engineer, Standard Underground Cable Co.
Pittsburg, Pa.

the periodicity, and of very few turns; and the secondary of many turns and high resistance.

Some other points I have noticed are as follows:

1. In addition to the method of selecting telegraphic messages by core transformer, and use no condenser in the secondary, though I may use one in the primary, this depending upon the capacity of the collecting wire and the periodicity of the waves.

I do not believe in the use of iron in the core, and I do not believe in the use of a condenser in the secondary, though it may be an advantage where the core is of iron. A little leakage of current from the battery through the secondary is of no account. The air core the use of different periodicities and suitable capacities and inductances, which was invented by the writer in January, 1892, at the request of Dr. Dudley, of the Pennsylvania R. R., to enable that company to get over certain difficulties, and the experiments on which led me to the conclusion (see ELECTRICAL WORLD, Sept. 15, 1894), that the sine wave was the only proper signal for telegraphic purposes, another method can be used, i. e., synchronously running contact discs, a synchronizing impulse being sent out every half-minute, at which instant a smaller disc geared down from the large disc puts the synchronizing current on, this synchronizing current being obtained through the coherer as usual. By making the gaps ten times as wide as the contacts on the disc, any number of stations could intercommunicate without interference, and all discs could be synchronized from one central station. I have not made this apparatus up, but from previous work in similar lines (similar methods having been previously used by some well-known telegraphic engineers for other purposes) I know it would work.

2. For some work the coherer is not needed at all. In fact, my experiments seem to show that it is not really necessary. For if the secondary be unwound from the air core transformer, and coherer and all disconnected, and a light aluminum ring hung by a thin phosphor bronze wire in the centre of the primary, this galvanometer

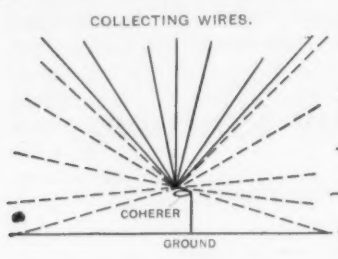


FIG. 2.

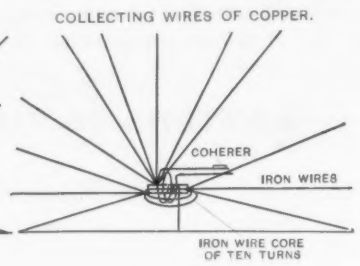


FIG. 3.

(which is not original with me, but I do not know who invented it) will give good indications; and if it be made to bear on two balanced microphonic contacts (the adjusting is a little difficult at first), it can be made to work a regular telegraphic relay. In this case, however, it is better to make the cross-section of the primary smaller and use more turns. A condenser can be put in series with the primary for selecting signals as with the other form. (See Fig. 1.) The aluminum ring may be in a permanent magnetic field.

As regards the leading wires, they are best made fan shape and at a distance apart of about one-eighth wave length at the top. The wave from a large area then ties itself into knots round the wires and the electrostatic potential slides down. Also two other fan-shaped semi-quadrants of thin iron may be put out as shown in sketch (Fig. 2), with the central wire running to the coherer if it contains magnetic particles; or, if the transformer be used, the iron wire joining the iron wings may be carried ten or more times through the primary with good results. (See Fig. 3.) This gathers in the magnetic displacement from that part of the wave which escapes by the side of the copper wires. Either can be used alone. Or, if the short-circuited dynamotor be used, it may be carried through the aluminum ring, which should then be placed in an unidirectional field. All these methods, though tried on a small scale, seem to be improvements.

REGINALD A. FESSENDEN.

ALLEGHENY, PA.

Illumination of Tower Clocks.

To the Editors of Electrical World and Engineer:

Sirs:—I have noticed recently accounts of several patents for illuminating tower clocks, which subject is one I experimented with about twenty years ago. The results of my experiments was an arrangement which accomplishes three important objects: It does away with expensive ground glass dials, with the necessity for inside lighting and enables the time to be told from a very great distance. There are but three incandescent lamps to each dial—a red lamp on the end of the minute hand, a green lamp on the end of the hour hand, and a white frosted or yellow lamp on the centre post. The dial itself is not illuminated, the time being told by the position of the red and green lights as they move around the white one on the centre post.

In an experiment it was found that with a five-foot dial the time could be readily determined within a minute or two at a distance of 2,400 feet, which would be impossible in the case of dials lighted from the inside of a tower.

The lamps may also be rigged out on light extension pieces to about double the length of the hands, which has the effect of making the dial appear twice as large, and increases the distance from which the time may be noted. I did not patent this system, and give it to the world for what it may be worth.

INDIANA, PA. EDWARD ROWE.

Coherer Action.

To the Editors of Electrical World and Engineer:

Sirs:—In your journal of July 29 there is a letter under the head of "Coherer Action," requesting an explanation of an experiment.

It appears the experiment is made as follows: A battery, galvanometer and coherer are placed in series, and when a wire is put in shunt with the coherer for an instant the coherer conducts to a certain extent.

My explanation of the above action is that when the shunt wire is removed to test the coherer's conductivity, the self-induction at break of its removal rushes into the coherer, and makes the connections. I do not think the tinfoil wings on each side of the coherer have much to do with the action.

When a non-inductive resistance is put in place of the galvanometer the conductivity of the coherer is not increased as much as when the coil of the galvanometer is in circuit at the break of the current; which shows that the self-induction of the galvanometer coil is greater than that of the resistance used in its place.

I would suggest in testing the conductivity of the coherer, it be removed without disturbing the current and the filings, if possible.

BALTIMORE, MD. ALFRED G. DELL.

To the Editors of Electrical World and Engineer:

Sirs:—Mr. Shoemaker in your issue of July 29 asks why short circuiting a coherer produces a reduction in resistance, and why the introduction of a galvanometer in the same circuit produces much better results, reducing the resistance to even a still greater degree.

I have been making experiments with coherers for the past two months, and have noted the two actions encountered by Mr. Shoemaker in his researches. I find that the resistance of a coherer is reduced, not only by short-circuiting, but merely by touching one of its poles with any part of a short-circuited current-bearing wire; and also upon the introduction of a telephone receiver, galvanometer or any electrical instrument having a few turns of wire in its construction. The resistance of a coherer is reduced much more by the self-induction produced in the turns of wire which, by its higher electromotive force, acts more promptly upon the filings, causing them to amalgamate firmer and thereby offering less resistance for the passage of the current through them—the tapping of the coherer tending to loosen the filings from each other or to cause them to decohere and offer again their former resistance to the passage of a current.

My explanation of the action referred to of the coherer is that in all instances a current when passing through an irregularly formed conductor, widens out where the conductor is broader or bulkier, and is confined within the narrower places of the conductor in making its circuit. The filings included in a circuit directly or indirectly, are very sensitive to the presence of a current in their immediate locality, aside from the current passing in the coherer itself.

NEW YORK. S. Z. FLINT.

Oxidation of Carbon at Ordinary Temperatures.

To the Editors of Electrical World and Engineer:

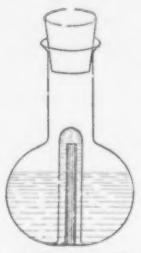
Sirs:—In a paper "On the Oxidation of Carbon at Ordinary Temperatures by Means of Atmospheric Oxygen with the Production of Electrical Energy," by Mr. Willard E. Case, read before the Royal

Society in June, and published in the ELECTRICAL WORLD AND ENGINEER, July 22, 1899, there is given what appears to be an experimental demonstration of a reducing action exerted on ferric chloride by the residue of burnt sugar.

It is stated that this reduction is the result of oxidation of pure carbon according to the following equation:

$$2Fe_2Cl_6 + C + 2H_2O = CO_2 + 4FeCl_2 + 4HCl.$$

and it is claimed that through this reaction the energy of the carbon is liberated as electrical energy. The only proof of this claim is the one that has so often proved fallacious, namely, the detection of an electromotive force is an electrolytic cell comprising the reagents of the said reaction.



OXIDATION OF CARBON.

In a communication published in this journal July 29, I have shown that the chemical energy of this reaction alone could not produce more than about half the electromotive force observed by Mr. Case, and that this energy is not derived from the carbon, but from the other reagents if the reaction really takes place. In that communication I was unable to deny the statement of Mr. Case that the reduction of the ferric chloride was due to the oxidation of pure carbon. In an experiment, performed for the purpose of confirming with ordinary electric-light carbon of great purity the results obtained by Mr. Case with the residue of burnt sugar, I was unable to confirm either the oxidation of the carbon or the reduction of the ferric chloride. The experiment was performed as follows:

A solution of ferric chloride of specific gravity 1.1 was acidulated with 1 per cent. of hydrochloric acid and placed in a large glass flask together with a test tube containing a rod of electric-light carbon three inches long and one-quarter-inch in diameter. The carbon and the test tube were completely covered by the solution. The solution was then boiled for three hours, at the end of which time all absorbed gases appeared to be completely expelled from the carbon. The test tube containing the carbon was then raised bottom upwards into a vertical position so that it remained completely filled with the solution, as shown in the accompanying figure. The object of the test tube was to collect any CO_2 or other gases that might be formed by chemical action on the carbon.

After the apparatus stood 48 hours in this condition, no trace of CO_2 was found in the test tube or on the surface of the carbon. A sheet of platinum covered with a deposit of platinum black was then inserted under the test tube in contact with the carbon. The apparatus has been standing in this condition 11 days and no trace of CO_2 or other gas has yet formed. Nor is there any indication of any chemical action whatever.

C. J. REED.

PHILADELPHIA, PA.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

Transformer Economy.—LEONARD.—A paper read before the Canadian Electrical Association, the first part of which deals with modern transformer designing. Of the two general types now in use, known as the shell type and the core type, the superiority is claimed for the former, as for an equal investment in material and labor, with proper design, a better transformer can be built of the shell than of the core type. The hysteresis loss is discussed, and it is pointed out that this loss may increase considerably during the use of the transformer, if proper precautions are not taken in the selection of iron and provisions made in the design to maintain it at a low temperature. Central station managers are advised to test their transformers, and some hints are given how to apply transformers properly in central station practice; instead of many small transformers it is preferable to use a small number of larger transformers with secondary networks, preferably on the three-wire system.—*Can Elec. News,* July; *El'ty,* Aug. 2.

Small Enclosed Motor.—A short illustrated description, with working drawings and an efficiency curve, of a small motor of the bipolar enclosed type, intended more especially to be directly connected to a ventilating fan. The novel feature is the laminated field ring which is built up of circular iron stampings provided with proper projections to form the field cores and pole pieces, so that when they are assembled and bolted together they form a solid ring with the pole pieces complete.—*Eng. News,* July 27.

LIGHTS AND LIGHTING.

Proper Efficiency of Incandescent Lamps for Central Stations.—CARY.—A paper read before the Canadian Electrical Association. A table is given, containing the results of many tests, showing the efficiency and the average life of lamps at normal voltage or at those other than normal. If, for instance, a station is using 3.5-watt lamps at absolutely steady normal voltage, an average life of 900 hours can be expected; if the voltage is 2 per cent. higher than normal, the efficiency is 3.27-watt per c.p. and the life is 700 hours; if the voltage is 4 per cent. higher than normal, the efficiency is 3.05 watts per c.p. and the life is 550 hours, showing how vitally important it is for central station managers to know the voltage at which their lamps are running at different portions of their line. Unless the regulation throughout the system is unusually uniform, it is most profitable to have the entire system divided into sections or zones, and order lamps of different efficiencies adapted to give the life determined upon as the best. If the fluctuations are approximately the same in the different zones, then the same efficiency can be used, but the lamps should vary in voltage, the voltage to be used being the same in each zone. He also gives a table of currents in amperes taken by lamps at various voltages and the candle powers at different efficiencies. As to 220-volt lamps, he remarks that great progress has been made in their manufacture during the past year or two, but that further progress is necessary in making them more efficient before they will be on a par with 110-volt lamps. In addition to this, more plants of 220 volts must be constructed so as to increase the demand. The conclusion of the paper is a description of the Nernst lamp.—*Can. Elec. News,* July.

Long Burning Enclosed Arc Lamps.—TURBAYNE.—A paper read before the Canadian Electrical Association on the modern enclosed arc lamp. Special features in the feed mechanism of enclosed arc lamps are discussed, the governing principles being identical with those in the open lamps. As it is necessary to separate the carbons from three-eighths to one-half-inch, it is usual to have the magnets act directly on the upper carbon without the intervention of levers, and this calls for a long range magnet of considerable power. In order also to obtain good regulation it is desirable that the moving armature be of considerable weight, as compared with the weight of the carbon to be lifted, as a decrease in weight of the carbon is then not accompanied by an appreciable lengthening of the arc. A type of lamp which represents simplicity in the extreme is that in which the separation and feeding of the carbon is effected by the expansion and contraction of a strip of metal interposed in the path of the current, which device seems specially adapted to parallel burning enclosed lamps.—*Can. Elec. News,* July.

New Form of Incandescent Lamp.—A short illustrated description of the Desaymar lamp. The principle of it is that the filament is wound in the form of a coil around a specially prepared cylinder of a body which is brought to incandescence, apparently from the heat of the filament. The lamp is said to be brighter and it is claimed that only about half the energy is required to produce the same candle power, the saving therefore being about 50 per cent. It does not seem that any commercial tests have yet been made of it.—*L'Elec.,* July 8.

REFERENCES.

Oxide Lamp.—IRISH.—An illustrated communication giving a sketch of several oxide lamps designed by him within the last few years, and showing some of the steps leading to the Nernst light.—Lond. *Elec.,* July 21.

Nernst Lamp.—NERNST.—See the abstract on Electrolytic Conduction, under Electro Physics.

POWER.

Power Transmission in Christiania, Norway.—To meet the requirements of an increased demand, two water powers at a distance

of 6 and 9 miles respectively, from the city, will be utilized to generate 1600-kw, which will be transmitted by two-phase alternating currents at 5000 volts to a station in the city, where the current will be transformed by rotatory converters into continuous current at 600 volts.—*Elek. Zeit.*, July 20.

Power Distribution in a Workshop.—LASCHE.—A well illustrated translation of an article on the distribution of power in the workshops of the General Electric Co., in Berlin, where each machine tool is driven by its own individual motor; the feature of special interest is that the three-phase current is used. There are 422 different electrically-driven machine tools in use. For their cranes they prefer three motors in place of a throwover gear. In fineness of regulation the three-phase motors are said to be as good as those for continuous currents, and it is claimed that they leave nothing to be desired if only there are sufficient steps on the rheostat.—Lond. *Elec.*, July 21.

REFERENCES.

Water Power in Italy.—BIGNAMI.—An article calling attention to the lack of the industrial development in Italy and showing how the industries could be advanced by the modern methods of utilizing large water powers, especially as that country contains absolutely no coal. Electric installations are now made chiefly by foreign companies. Brief descriptions of some of the plants are given, together with the laws regulating the use of public water powers and the running of lines.—*Eng. Mag.*, August.

Short Distance Power Distribution.—SWINBURNE.—A short article of a somewhat popular nature on the advantages of the distribution of power over short distances and on the use of electric motors in workshops. The article is in the nature of a general introduction to the subject.—*Eng. Mag.*, August.

TRACTION.

Quebec.—A long article on the electric railway system. The three special features on this line are the high grades surmounted without the use of a rack rail; the amount of snow in the winter; the use of water power through a high-voltage transmission line, seven miles long. The town lies on a high promontory, the upper part being about 320 feet above the lower; the two sections are connected by two lines, one on a trestle, and the other on a steep street. On the connecting line built on the street the maximum grade is 14.15 per cent.; and at the top of this grade there is a curve with a 40-foot radius. The trestle contains grades of 4 per cent., 7 per cent. and 11 per cent., the latter being for a length of 300 feet. No special safety devices are employed, but there has been no accident on the grades during the two years in which the road has been in operation. The chief danger is in the descending trip, on which the speed is only four miles per hour; the ordinary hand brakes are used. The cars weigh complete about 7½ tons, and are equipped with two 30-hp motors. In ascending the 14.15 per cent. grade in summer about 65 amperes at 520 volts are required, except on the curve, where the current is about 130 amperes; in winter the average figures are about 100 and 195 respectively. The average power consumption at the station in summer is 8.3-kw per car per hour, and for the whole year about 9.5-kw. Each car runs about 106 miles per day. The snowfall in Quebec is very heavy; it amounted to 120 inches last winter. The company has 6 snow sweepers, each equipped with two 30-hp motors for traction purposes, and one 30-hp motor for revolving the brooms; also several horse-drawn plows and sleighs. The sweepers frequently take 230 amperes. The car wheels are cast iron, 33 inches in diameter, and the average life is 24,834 miles. Power is developed at Montmorency Falls, having a working head of about 195 feet. There are four 1000-hp turbines, each connected to a 600-kw two-phase alternator, with a frequency of 66 cycles per second. The current is transmitted to the substation at 5000 volts, and is there transformed to a direct current by a six-pole 540-kw rotary converter. The company is also planning to transform an existing thirty-six-mile steam railroad into an electric one.—*St. R'y Jour.*, August.

Pittsburg.—Additional particulars of this station, which was incompletely described in the March issue. The generators are nominally rated at 1460 amperes, but guaranteed to carry 1820 amperes, with a rise of not more than 40° C. in any part of the machine, and carry 2560 amperes for a short period; the generator is directly connected with the engine. The switchboard is arranged to use either the three-wire or the two-wire system, the latter being used at present. A full page diagram of the proposed arrangement of feeders when running on the three-wire system, is given.—*St. R'y Jour.*, August.

Amiens.—A short article on an electric tramway at Amiens, France. It is 18.7-km long, and the track is laid with 36-kg rails; there are 28 motor cars, capable of carrying 38 passengers; the cars are equipped with a single 25-hp motor, controlled from each platform by a rheostat controller. The power station contains three single expansion, horizontal Corliss engines, with cylinder dimensions of 560-mm by 1220-mm, each belted to a 150-kw generator.—*St. R'y Jour.*, August. Int. Ed.

Repair Shop Hints.—Some hints concerning repair shop practice for street railways. The first is a method of testing armatures while still in the lathe, and either before or after the binding wires have been put on. A pole piece, similar to those used in the motor, is attached to a swinging frame, and so arranged that it can be brought around the armature, or swung away from it. An alternating current is then passed around this pole piece, and the armature is slowly turned in the intense magnetic field thus produced; any defective insulation is then quickly shown by the buzzing sound which is produced. Boiled linseed oil is used extensively for treating armature and field forms. Three winders and three helpers do all the repairs for the 135 motors used by that company, which also manufactures all its own brass work, including trolley wires, overhead appliances and car trimmings.—*St. R'y Jour.*, August.

Traction Repair Shops.—An article on the labor-saving tools and methods in the West Chicago repair shops, which are said to be among the largest in America. The company manufactures all its own trolley wheels, overhead switches, car trimmings and fenders. The motor bearings are renewed every sixty days, whether worn out or not. The motor brushes are changed every day, and allowed to soak in vaseline. Only four men are required to make all armature and field repairs on 400 motors. Some of the commutators have been in use for four years without being touched. Great care is taken to have the two motors on a car exactly alike as regards winding and size, as otherwise it is found that one of the motors will do a larger part of the work.—*St. R'y Jour.*, August.

Rheostat for Testing.—A description of a convenient rheostat for testing used in one of the power stations in Pittsburg. It consists of about 300 feet of No. 12 bare copper wire, wound upon a wooden frame and immersed in a barrel of water. This wire will carry 225 amperes at 550 volts if a stream of water is run continuously into the barrel. Usually a stream from a 2-inch hose is sufficient.—*St. R'y Jour.*, August.

Determining the Size of Feeders.—HERRICK.—A graphical method of proportioning feeders. The road is laid out on a horizontal scale, and ordinates are erected in length proportional to the ampere feet required. By the application of a table published in the last issue of that journal, the size of the feeders can then be graphically determined. The paper also includes two charts for determining the size of wire for simple electric transmission, and for multiple feeding.—*St. R'y Jour.*, August.

Plows for Underground Conduits.—A note stating that the plows for underground conduit roads are subject to as much, if not greater, repair than the overhead trolley. On a double truck car the plow is usually on a round 2½-inch steel bar, carried on a light but stiff steel frame on one truck; the wear from the slot rail is taken up by four soft malleable iron plates held in the shank of the plow, and these last about three days. The contact wires are carried to the plow by braids of small wire. The plows used in New York City are described.—*St. R'y Jour.*, August.

Electric Locomotives.—A short statement of the plans of the Orleans Railroad Company and the Compagnie des Chemins de Fer de l'Ouest, of Paris. The former will install some 25-ton electric locomotives, mounted on four axles each carrying a 25-hp motor. The power station will have a capacity of 2000-kw, and will distribute current on the three-phase system at 5500 volts. The latter is installing a large power station for railway and miscellaneous electric and power purposes, and also will install a number of electric locomotives.—*St. R'y Jour.*, August.

Third-Rail Line.—A short description of the proposed electric equipment of the Wannseebahn, between Berlin and Potsdam, which will be a third-rail road, each train consisting of nine cars, of which only the first and last will be equipped with motors; each will carry two 100-hp motors. In starting all four motors will be employed, but after that only those on the first car will be used.—*St. R'y Jour.*, August.

Street Railway Receipts.—A long table giving the gross receipts of 222 street railway companies in the United States and Canada for the years 1897 and 1898, with the percentage of increase or decrease. Of

the total number of roads given, 26 had gross receipts in 1898 of $1,000,000 or over, 20 had from $500,000 to $1,000,000, 58 had from $100,000 to $500,000, 62 had $50,000 to $100,000, and 56 had $25,000 to $50,000.—*St. R'y Jour.*, August.

REFERENCES.

Duesseldorf-Krefeld.—BRAUN.—A long illustrated abstract of the description of this line, noticed in the Digest, July 22. The line was started a few months ago and is of special interest, as it is the first installation in Europe of a high-speed electric railway.—*St. R'y Jour.*, August.

Germany.—SCHIEMANN.—A long illustrated description of the electric railway connecting some towns near Witten in the Ruhr coal district in Germany. The line is now ten miles long. The usual overhead wire system is used.—*Elek. Zeit.*, July 20.

Leipzig.—A very short illustrated description of the great Leipzig tramways.—Lond. *Elec. Eng.*, July 21.

Florence, Italy.—A short description of electric railways.—*St. R'y Jour.*, August.

Accumulator Railway.—ZACHARIAS.—An illustrated translation in abstract of the article on the line in Ghent, noticed in the Digest, July 29.—Lond. *Elec. Eng.*, July 21.

Automobiles.—A very long, well illustrated description of the electric automobiles at the second International Exposition of the Automobile Club of France.—*L'Ind. Elec.*, July 10.

Some of the illustrations are reprinted in the *Elec. Rev.*, Aug. 2.

Accessories in Electric Traction.—COTTRELL.—In these continuations of his illustrated serial (see Digest, July 15), he continues the discussion of motor air compressors for brakes, roller bearings. gongs, track-scrapers and brushes, sand boxes and heaters.—Lond. *Elec. Rev.*, June 30 and July 21.

Electric Watering Carts.—A short note that a water cart has been recently tried in Paris which is driven electrically and in which an electric motor is used to distribute the water.—Lond. *Elec. Eng.*, July 21.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Installation Estimates.—The first part of an article giving practical information to assist in making rapid approximate estimates. Concerning the amount of illumination the following figures are given with the statement, however, that no definite rules can be laid down, the figures are therefore only to be used as a general guide. The number of candles per 10 sq. ft. is given as follows: For show windows 15, depending on the kind of goods; jewelry, for instance, may require four or five times as much light; ordinary workrooms in factories, 1 to 3-cp; for floors occupied by machinery, one or more lights per machine, rather than per floor space; shops without show windows, 6; stores and small warehouses, 2.5; private offices, 2; general offices, where there are many clerks, 2.5; anterooms, 1.5; drawing rooms in private house, 5; dining rooms, 3.5; bedrooms, 2; kitchens, 1.5; subsidiary rooms, 1. For hotel lighting as follows: Drawing room, 6; dining room, 10; best bedrooms, 4; small bedrooms, 3; corridors, 1.5; entrance hall, 2.5; office, 2; kitchens, 1.5; subsidiary rooms, 1. (These figures depend very largely on the color of the wall paper and decorations.) The estimate of the cost and weight of the generating plant is then discussed and a number of curves are given showing the costs of the whole steam generating plant, including details for various braking horse-powers and various kinds of engines, including steam, gas and oil.—Lond. *Elec. Rev.*, July 21.

Combined Lighting and Traction Plant.—A very long illustrated description of the plant in St. Helens, England. In 1897 a lighting plant was erected there with two alternators of a total of 145-kw. To meet the increase of business, the plant had to be enlarged, but on account of the desirability of providing for electric traction, the alternating system was given up and a combined lighting and traction plant was erected on the direct current system, with four dynamos of together 615-kw. The public lighting is done by arc lamps, run 11 in series off the 460-volt distributing mains. Each pole is also provided with two incandescent lamps, which are substituted for the arcs at midnight. The private lighting supply is carried out by means of a three-wire network, with 460 volts between the outers. The length of tramway line at present equipped is seven miles. Three miles from the plant a substation is erected, containing a battery of 250 chloride cells, giving an output of 150 amperes per hour, and having a booster of 6-kw.—Lond. *Elec. Rev.*, July 21.

Combined Lighting and Traction Plants.—ELWELL.—An abstract of a paper on the utilization of electric energy from an intermittent source, read before the Electrical Association of New South Wales. For Sydney he proposes to accumulate the surplus electricity from the tramway feeders, in substations situated in the best business centres and equipped with storage batteries, as has been proposed for New York.—Lond. *Elec. Rev.*, July 21.

Electric Lighting of a Gas Plant.—FIELD.—A description of a small electric plant for lighting gas works, in which there is danger on account of possible explosions. To avoid sparks in these rooms, keyless sockets are used, and the lights are operated by switches, either provided with special waterproof boxes or placed inside of cabinets. An electrical device for indicating at the works the exact gas pressure in the street mains, at the office building, etc., is described and illustrated.—*The Technic.*, Univ. of Mich.; reprinted in *West. Elec.*, July 29.

REFERENCES.

Central Station Accounting.—HART.—A paper read before the Canadian Electrical Association on central station accounting from a business standpoint.—*Can. Elec. News*, July.

WIRES, WIRING AND CONDUITS.

REFERENCES.

Protection of Low Tension Wiring Against High Potential Currents.—PLEWS.—A short paper read before the Canadian Electrical Association. He recommends replacing fuses with another device not already described, which seems to be merely the usual circuit breaker.—*Can. Elec. News*, July; *El'ty*, July 26.

ELECTRO-PHYSICS AND MAGNETISM.

Electrolytic Conduction of Solids at High Temperatures.—NERNST.—A short paper read before the German Electrochemical Society. As is well known, metallic conductivity increases very greatly at low temperatures and decreases at high temperatures; with electrolytic conductivity it is just the reverse, as at very low temperatures conductivity scarcely exists whereas at high temperatures, fused solids conduct quite well. That solids conduct electrolytically has been shown by many experiments; he has shown that the electrolytic conductivity of solid bodies at high temperatures is surprisingly high. The electrolytic conductivity of pure oxides increases slowly with the temperature and remains relatively small, but that of mixtures, especially of the oxides of magnesium, silicon and zircon, and of the similar rare earths, is enormously greater; he measured conductivities up to 4 and above, which is appreciably greater than that of the best conducting sulphuric acid. He first used alternating currents in order to avoid electrolysis, but later with continuous currents he found that a mixture of oxides can be kept incandescent for hundreds of hours without being destroyed by decomposition; but this is not due to metallic conductivity. In general it may be said all metallic conductors even in thin layers, are not transparent, while the materials of his incandescent body are decidedly translucent; this is in accordance with the electromagnet theory of light according to which metallic conductors transform the light rays into heat, while electrolytes for such rapid oscillations are insulators. He believes that in the optical absorption of light there is a criterion for determining whether the conductivity is metallic or electrolytic; the electric arc, for instance, does not conduct metallically, and the good conductivity of the bluish solution of sodium in liquid ammonia is not to be ascribed to metallic conductivity; certain metallic oxides and peroxides of great opacity are apparently metallic conductors. He also gives other proofs that the conductivity of his incandescent bodies is electrolytic; colored oxides, like those of iron and cerium, may be clearly seen to travel to the cathode; rods which contain much magnesia show a decided growth at the cathode; rods heated by continuous current clearly show polarity and the cathode is always much darker than the anode; he explains this by the fact that metal is set free at the cathode, and immediately takes oxygen from the air, while at the anode the oxygen is set free, and therefore the material near the anode is poorer in the dissolved conducting material, which increases the resistance, and therefore the heat produced; under normal conditions, therefore, there is no change in the incandescent body than that oxygen enters at the cathode and is set free at the anode; oxygen is therefore necessary for lamps heated with continuous current. The constancy of well made rods for his lamps is claimed to leave nothing to be desired, and he believes that with iridium electrodes such rods can be used for pyrometers for much higher temperatures than those for which they are made at present. The current which maintains the rods at incandescence is therefore only a residual current which he

calls a "Reststrom" (see Digest, Dec. 4, 1897); this current, which is small at ordinary temperatures, becomes very important at the very high temperatures in this lamp, at which the true electrolysis almost disappears and the bodies therefore have apparently a metallic conductivity, which is a very useful phenomenon in practice for the production of light. (This "Reststrom" appears to be what is otherwise known as a concentration current; it is a current due to the fact that oxygen is set free at one electrode and is absorbed again at the other.)—*Zeit. f. Elektrochemie,* July 13.

Self-Recovering Coherer, and Coherer Action.—BOSE.—A Royal Society paper describing an interesting self-recovering coherer and giving the results of investigations concerning the coherer action of different metals. In order to overcome the effects of a damp climate on coherers made of iron or steel, he uses instead fine silver threads wound in narrow spirals coated electrolytically with cobalt, which makes them highly sensitive to electric radiation. In his researches he complied with the conditions which are more favorable to making the coherer sensitive, namely, the proper adjustment of the e. m. f. and of the pressure of contact best suited for each particular receiver; the account of his researches is given in detail. All metals exhibit contact sensitiveness, the general tendency being toward a diminution of resistance due to electric waves; an interesting and typical exception, however, is the receiver made with potassium, which not only shows an increase of resistance due to the action of radiation, but also a remarkable power of self-recovery. With other metals an increase of resistance is usually accidental, but this is not the case with potassium, with which long series of experiments were made. There is a striking similarity between the action of electrical radiation on potassium, and the checking action of visible radiation on the spark discharge; in the latter case potassium is also photo-electrically most sensitive. The instantaneous recovery with the sensation of radiation is found to persist and the receiver responded uniformly with an increase of resistance as long as it was kept immersed in kerosene in order to prevent oxidation. (No description of the construction seems to be given.) For manganese the tendency is either to increase or decrease the resistance according to the adjustments of a very sensitive set of conditions; there is little tendency to recovery.—Lond. *Elec.,* July 21.

The article is discussed very favorably in an editorial in which special attention is called to the rapid and automatic power of decoherence of the potassium coherer and to the practical importance of this discovery. It is also remarked that the old theory that coherence is a specie of welding together of the contact surfaces, does not agree with the behavior of potassium.—Lond. *Elec.,* July 21.

Magnetism and Molecular Rotation.—With reference to the telegram of Lord Kelvin, noticed in the Digest, July 29, a theoretical article of Blondlot from the *Jour. de Phys.,* 1890, p. 177, is quoted editorially, which gives a good account of the deductions by which the same conclusion as that reached by Lord Kelvin, might be arrived at. The conclusion of this article is as follows: "The same displacement given to an electric charge and to a magnetic pole, having equal numerical values, produces in each point in space correspondingly equal magnetic and electric forces."—Lond. *Elec.,* July 21.

PHILLIPS.—Referring to the communication of S. P. Thompson on the Phillips phenomenon (Digest, July 29), he agrees with the suggestion that the effect observed is largely due to a radial flow of ions from the inner surface of the glass walls of the exhausted vessel towards the interior magnetic electrodes. But the complete explanation would involve conceptions of ionic activity of a far greater complexity than seemed necessary at first. In relation to Kelvin's letter (Digest, July 29), he calls attention to the fact that the ring in the Phillips phenomenon, when once formed, can remain visible for a minute or more and is not necessarily a momentary effect which ceases as soon as the magnet field has reached a steady value.—Lond. *Elec.,* July 21.

BARR.—A short communication questioning a part of Thompson's theory of the Phillips effect.—Lond. *Elec.,* July 21.

Theories of Atmospheric Electricity.—CHAUVEAU.—An abstract of a French Physical Society paper. For the investigation of the atmospheric electricity he considers the following questions the most important: The direction of the field, variation of the mean value of the intensity with the geographic position, diurnal variation, and the variation of the field with the heigl.t; the double oscillation does not represent the true law of the diurnal variation. Some results of measurements made in balloons are quoted. A satisfactory explanation of the predominance of positive masses at a height of 1000 to 4000-m has not yet been given. Lenard's and Edlund's theories of atmospheric electricity are briefly discussed.—*L'Elec.,* July 8.

REFERENCES.

Physical Properties of Matter.—SHETTLE.—An article suggesting some theories to explain how various properties of matter are acquired. Most of the properties he claims are due to the relative proportions of matter and ether in the substances. (His theories would probably not find general acceptance.)—Lond. *Elec., Eng.,* July 21.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Wehnelt Interrupter.—HEINKE.—The first part of a long illustrated account of experiments with the Wehnelt interrupter. The current was measured by a continuous current amperemeter in series with an alternating current amperemeter. It was found that the interrupter did not completely interrupt the current, but produced a current like a combination of an alternating and a direct current. The theory of the intermittent continuous current ("wave current") is given.—*Elek. Zeit.,* July 20.

REFERENCES.

Automatic Two-Rate Meter.—A brief illustrated description, but showing no internal construction, of a meter made for both continuous and alternating currents. The special feature is that the registrations at both of the tariffs are made separately, the lower row of dials being for currents up to a certain prearranged amount, after which an electromagnet throws the gear on to the upper row of dials and down again to the lower one when the current falls to a certain amount.—Lond. *Elec. Eng.* and *Elec.,* July 21.

Safety Device.—Brief illustrated discussions on the question what device could be used in an experimental laboratory, supplied with both 2000 and 100 volt mains, to protect the latter if by accident the current at the larger voltage were to be sent through them.—Lond. *Elec. Eng.,* July 21.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCES.

Telegraph and Telephone Statistics of the World.—SCHMITT.—Statistics for the year 1896, compiled apparently from various sources.—*L'Elec.,* July 8.

Methods of Transmitting Intelligence.—SHEPARDSON.—An article of a popular, general and historical nature.—*Year Book,* Univ. of Minn.; reprinted in the *Elec. Rev.,* Aug. 2.

U. S. Signal Corps.—GREELY.—A short general article on the methods used.—*Ainslee's Mag.;* reprinted in the *Elec. Rev.,* Aug. 2.

MISCELLANEOUS.

Electrical Heating and Cooking.—DUNLAP.—Niagara Falls water power is used for lighting, heating and cooking in the new building of the Carmelite Fathers at Niagara Falls. The plant consists of three transformers of together 85-kw primary 2200 volts and three-phase secondary 110 volts. The total amount of power used in the building is 100-hp, 25-hp being applied for lighting, cooking and heating water, and 75-hp for heating the lower floor of the building. The electrical kitchen has a capacity of cooking all the meals of the residents and guests; it is operated by an electric combination range and three electric ovens. The range has a heating surface of 6 square feet. Each square foot of surface has its individual switch and can be controlled at full or half heat, as desired. The range, as a whole, consumes 90 amperes, and each square foot of surface 15 amperes. There are two small ovens and one large one. Each of the former has three compartments, each compartment consuming 23 amperes. The large oven takes 50 amperes, and accommodates four large roasts at one time. A 400-gallon boiler in which water is heated for laundry and bathroom purposes takes 120 amperes. At the recent formal opening a dinner was cooked for 250 persons in 2½ hours. The cost of the 25-hp used for lighting, cooking and heating water is $625 per year. The current used for heating the lower floor is in use but a small time in the winter and is supplied at a very low price, as at that time there is a surplus of power in the station. The article is well illustrated.—*West. El.,* July 29.

Paradoxical Cases of Branching of Currents.—BREISIG.—An illustrated paper read before the Electrotechnical Society of Berlin on two cases, in which a current is divided into components, one of which is larger than the original undivided current. The first case, for alternating currents, is that in which a condenser of great capacity and small ohmic resistance is connected in parallel with an

induction coil of high reactance and small resistance. The other case, for continuous currents, exits if a series motor and a shunt motor are connected in parallel, both being belted together so that the speeds are relatively the same.—*Elek. Zeit.*, July 20.

New Books.

DYNAMOMASCHINEN FUR GLEICH- UND WECHSELSTROM. By Gisbert Kapp. Berlin: Julius Springer. Third Edition. 486 pages, 200 illustrations. Price, 12 marks.

Although this book contains a vast amount of extremely interesting and useful information for students of the design of electrical machinery, chiefly due to the condensed manner in which such a large subject is treated, we regret that the work is not as complete as might be wished, and offers but few new features for the English reading public who have access to other works on the same subject, as, for example, to Prof. S. P. Thompson's treatises on direct and alternating current machinery, which most exhaustively enter into the theory and the practical design of electrical apparatus. The book is, however, written most interestingly and well deserves to be recommended.

Of unusual interest are the two additions made to this last edition, the first of these dealing with parallel running of alternators, and the second with rotary converters. Since these chapters have not appeared in the previous editions, and they give some novel features not before discussed in other works on similar subjects, we believe it of interest to review them somewhat more extensively.

Regarding parallel running of alternators, Mr. Kapp discusses the necessity of ascertaining the correct rate of angular rotation per revolution, and states that this is more important than a close speed regulation—that is, such a regulation of the engine that the speed does not vary more than a few per cent. between no load and full load.

In order to accomplish this close speed regulation per revolution, large fly-wheels are necessary, and preferably all moving parts of the engine should be so counterbalanced that the effect of the moving masses is very small. The difficulty of parallel running is directly dependent upon the number of poles of the alternator, so that whereas it may be very easy to run eight-pole machines in multiple, eighty-pole machines may be very difficult unless the engine regulates extremely close. The more steam impulses per revolution, the easier is it to obtain a uniform rate of rotation, so that, for instance, a single-cylinder double-acting engine is inferior to a cross-compound double-acting or triple-expansion engine, etc. Yet even if the rate of rotation is quite as uniform as would be desirable, hunting between direct-connected generators can occur. This tendency is dependent upon the relation of natural periods of the engine and the alternator.

Mr. Kapp has given a very complete theory of this "pendulum action," as he calls it, and deduces equations by which it is possible to ascertain in each case the probability of hunting—that is, the probability of accumulation of cross currents between the machines.

As a rule, the period of the engine is small compared with the period of the alternator, say one-fourth or one-fifth of that of the engine. In order to make the period of the alternator short—that is, of about the same magnitude as the engine (which undoubtedly would make a more stable condition, provided that the relation between the periods is favorable, that is, is an even number)—the weight of the fly-wheel should be as light as uniform rate of rotation will permit, and the machine should have a relatively low armature reaction.

There are two ways to change the relation of natural periods of alternator and engine running at given speed, one being to change the weight of the fly-wheel and the other to change the armature reaction of the alternator; or which in this particular connection is equivalent, change the amount of self-inductance inserted between the bus-bars and alternator, since in armature reaction is included not only the demagnetizing effect of the armature current, but all self-inductance in circuit, including that between the bus-bars and the alternator. If however, it is permissible to change the speed slightly, this gives the easiest way of changing the relation, since the ratio of the alternator and the engine is proportioned to $1/\text{frequency}^2$.

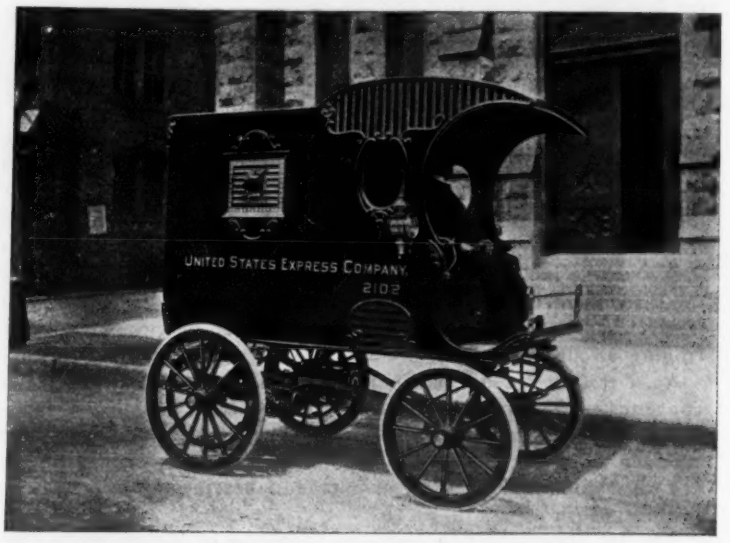
Regarding rotary converters, Mr. Kapp goes very completely into the effect of length of pole arc on the ratio between alternating and direct-current voltage and output of the machines for same heating, etc. We regret, however, that we cannot agree with him in this discussion, which under certain conditions may possibly hold for double-current machines—that is, dynamos which furnish both alternating and direct current—but not, in our opinion, for machines which convert alternating into direct current. In the latter case the direct-current voltage depends upon the wave shape of the impressed alternating current, and therefore on the generator wave shape and not upon the counter e. m. f. of the machine itself. But even with the double-current machines, we doubt very much that the e. m. f. is so much dependent upon the ratio of pole arc and pitch as given by Mr. Kapp.

In deducing the ratio between the e. m. f. which is obtainable and the e. m. f. corresponding to a sine wave of flux, Mr. Kapp has made the assumption that there is no stray field. Such stray field must, however, exist in all machines, and its effect cannot be neglected. Machines ranging in pole-arc between 40 and 85 per cent. have been found to vary in e. m. f. but 10 per cent., whereas, according to Mr. Kapp, this would vary over 25 per cent. The length of the air gap is of importance, and a machine will have a very much less stray field if the air gap is short than if long; consequently, the gap should enter into any conclusion that can be drawn regarding the effect of pole arc. In general, such double-current machines have their pole faces shaped similar to direct-current machines, which permits of considerable stray field, and the ratio is therefore practically the theoretical value—that is, that corresponding to the sine wave of flux.

According to the author, the relation between output of converters as a function of the wave shape of field flux—or which is equivalent, the width of pole and the pitch—is, if the distribution of magnetic flux is of sine wave shape, for a single-phase converter 85 per cent. of the direct-current power. If the pole width is two-thirds of the pitch, the output is 88 per cent., and if it is one-half of the pitch 95 per cent., which would show that a machine as built in practice gives more output than the theoretical machine with sine-wave distribution of flux. He also shows that in two-phase machines the effect of pole width is not as essential as in three-phase machines, and deduces theories for single-phase, two-phase and three-phase rotary converters, and the distribution of current and heating for different phase relations of alternating current in the armature.

Delivery Wagon for the U. S. Express Company.

One of the fields in which the automobile is destined most largely to distinguish itself and in which it has already come into employment with marked advantage is that of the delivery wagon. The recent figures presented by Professor Sever and Mr. Fliess before the American Institute of Electrical Engineers, on delivery wagon service, were an eloquent and convincing statement of the case in plain arithmetic, and it is needless to say that such data is making a deep impression on those who have to conduct any business requiring a large number of vehicles in the transportation and delivery of packages around any large city.



ELECTRIC EXPRESS DELIVERY WAGON.

The United States Express Company, of this city, of which Senator Platt is president, has now taken the subject up, and will, it is understood, put a line of automobiles into service at an early date. Its first wagon has already been built and delivered to it by the Fischer Equipment Company, of Chicago, whose chief engineer and designer is Mr. C. E. Woods. The wagon has been under test at Baltimore and elsewhere, and its performance is most

highly commended. The wagon, which is shown in the accompanying cut, is of the "special hood" type, and has a carrying capacity of 1200 pounds. On one charge of the battery a run of thirty miles can be made, and the maximum speed is ten miles an hour. There are 40 cells of battery. Grades up to 6 and 8 per cent. can be climbed, and the regulation permits of several speeds forward and backward. The motors in these wagons are carried on the rear axle. The batteries are grouped on each side of the wagon, leaving a large central space open for packages. The wheels are built with wooden spokes. The total weight is about 2500 pounds, and the cost averages about one dollar per pound for the whole wagon—a figure which seems to apply fairly well through the whole range, at present, of automobile work, in vehicles of the electrical class, unless they are of a specially luxurious character. In these delivery wagons a handsome touch or finish is given by the heavy plate glass illuminated signs at the side.

FIG. 1.—PORTABLE TESTING TELEPHONE SET.

FIG. 2.—INSTRUMENT IN USE.

FIG. 3.—INSTRUMENT FOLDED.

A Portable Testing Telephone Outfit.

The instrument shown herewith is a complete telephone in portable shape, enclosed in a wooden box measuring less than seven inches square, and fitted with a convenient leather handle or strap for carrying. The magneto is wound to any ohmic resistance required in telephone work, and packed in the box is a talking battery. The most noticeable feature of the instrument, and the one which makes its compact construction possible, is the consolidated receiver transmitter.

This instrument consists of a solid back transmitter and a double-pole receiver of the standard size, fixed on either end of three sections of tubing. The larger section contains the induction coil. A hinge in the tubing enables the instrument to be folded in the small compass shown in Fig. 3. The hinge also performs the important function of a switch, connecting up, when the instrument is opened ready for use, the talking circuit. When it is closed the talking parts are thrown out of circuit, and the ringing circuit is completed.

As a testing set for telephone linemen, the outfit is especially convenient. The ordinary testing set comprises, beside the generator, nothing more than a receiver. The lineman must shift the receiver from his ear to his mouth in communication with the central station, and thus the advantage of hearing his own voice in testing is lost.

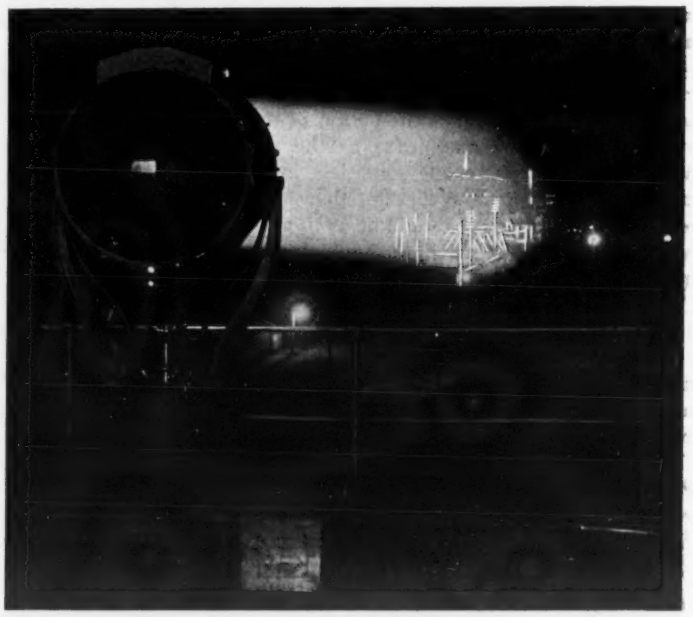
The set illustrated is a complete telephone of higher grade than that in ordinary service. The lineman may snap it to the line anywhere, and enjoy all the benefits a complete telephone gives him. An arrangement of a button on the side of the box enables the lineman to get a ring back from the central station without closing the receiver-transmitter. The button closes the ringing circuit; if only a ringing test is required, the magneto is worked in the ordinary way, and the receiver-transmitter left at rest. No parts need be disconnected.

Other important uses to which the new set is adapted are those of service in electric railway work, the instrument being carried on each car in the motorman's box or any other convenient place. With the telephone used in this connection, a jointed road long enough, when lengthened, to reach the telephone line, is carried in the car. Wires run through the rod from a hook at one end to a cord provided with a small lamp. The motorman requiring to use the telephone hooks the rod over the line clamp, the cord mentioned to the rail, and snaps the telephone on to a small protuberance for that purpose on the rod, and he is in communication with the power house.

The folding instrument is also employed in the intercommunicating systems manufactured by the Smith Company in connection with a special switching device. The latter is composed of a series of points within the segments of a half circle, in which the receiver hook moves. Contact is established by pushing the hook opposite the point marked with the name of the station wanted. Replacing the receiver on the hook, carries the latter back to the home station automatically. The entire device is composed of but few parts, and is extremely simple in the operation. The manufacturers are the Smith Interchangeable Telephone Company, 1304 Chamber of Commerce, Chicago.

Searchlight Projectors.

One of the most interesting departments to the visitor at the General Electric shops in Schenectady is that devoted to searchlight manufacture and testing, and recent work observed there shows that very rapid strides have been made in this country in a line of work the best examples in which once came from abroad. To see the tests made one has to be at the works after dark, but the time thus spent is well repaid. Curious and startling effects



SEARCHLIGHT IN OPERATION.

are observed in the way of picking out objects at a distance, and a regular range of distances, clearness of perception, etc., has been laid out, so as to standardize the work and meet the requirements whether for the Government services or for the uses of commerce.

The new line of projectors made by the company includes sizes ranging from 9 to 36 inches in diameter, and in these projectors all the latest available improvements have been combined. All the commercial projectors are fitted with Mangin ground glass, silver-plated lens mirrors. This type of mirror has two spherical surfaces of different radii, and the reflection and refraction of the glass cause the rays of light to be projected in a parallel beam absolutely free from all black spots when the arc is in the focus. The projectors made for the Government have parabolic ground glass, silvered lens mirrors, with true parabolic surfaces, and are specified for standard use by the Navy. They give a whiter light, and have, therefore, a more penetrating beam. The cost is, however, much higher.

All the General Electric projectors are fitted with automatic ratchet feed focussing lamps. They are designed to throw the greatest possible amount of light on the reflector and screen shutters are provided to prevent the direct rays from leaving the projector, so that all are reflected and sent out parallel. The carbons are fed automatically toward each other, and the arc remains in the focus of the mirror until they are entirely consumed. The carbon holders are arranged for vertical and horizontol adjustment of the carbons, and the centering and focussing of the arc is effected by means of a magnet placed inside the projector and surrounding the arc on all sides but the top. The lamps work on direct current, constant potential circuits, with a regulating resistance in series, the potentials used ranging from 40 to 60 volts, according to the size of the lamp, etc. The various methods of control are all provided for, and provision is made for conditions that may vary from the normal as to the requirements of the work.

The North Multiple Telephone Switchboard.

The North Electric Company, of Cleveland, Ohio, to whom may be credited a number of innovations and improvements in the telephone field, have, since getting into new quarters, enlarged their scope of operation, and are now bringing out, among other novelties, an ingenious multiple switchboard intended for exchanges that have hitherto used trunking systems between operators. The board illustrated, which is in use at Wooster, Ohio, is the type specially designed for exchanges of from three hundred up to six or seven hundred drops. For larger exchanges the type of board manufactured is somewhat different from this one.

This board has, it is said, all the conveniences of large multiple boards, and by cutting down the force of operators and giving quicker and better service should become very popular. All line drops and clearing-out drops are armored and wound with the best silk insulated wire. They are mounted in strips of ten, and easily removed when necessary. The line jacks and multiples are strong, and made of the best spring metal. Any jack may readily be removed. All connections in the board where there are not rubbing contacts, are soldered and easily accessible. The wiring to drops, line jacks and multiples are thoroughly insulated and laced. Rubber of the best quality forms the insulation, and the possibility of trouble from cross-talk, induction or stray currents, is reduced to the minimum.

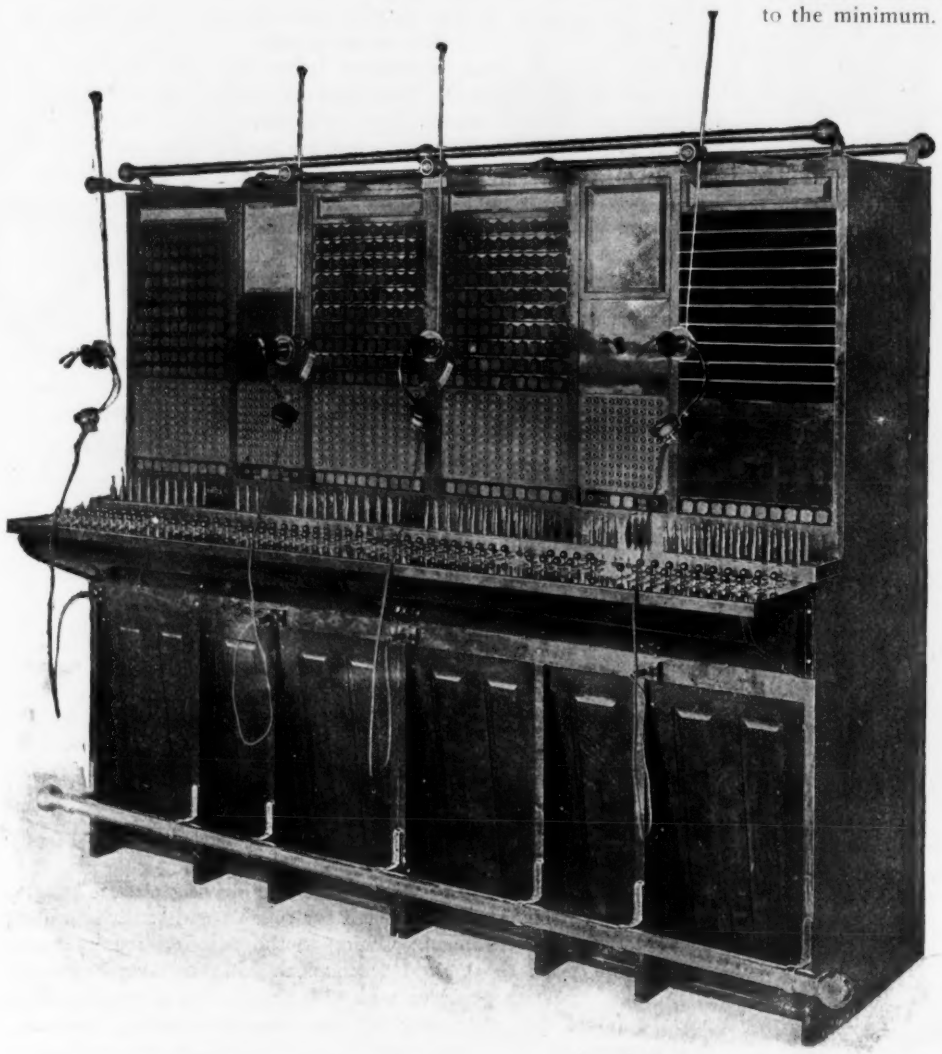


FIG. 1.—FRONT VIEW OF BOARD.

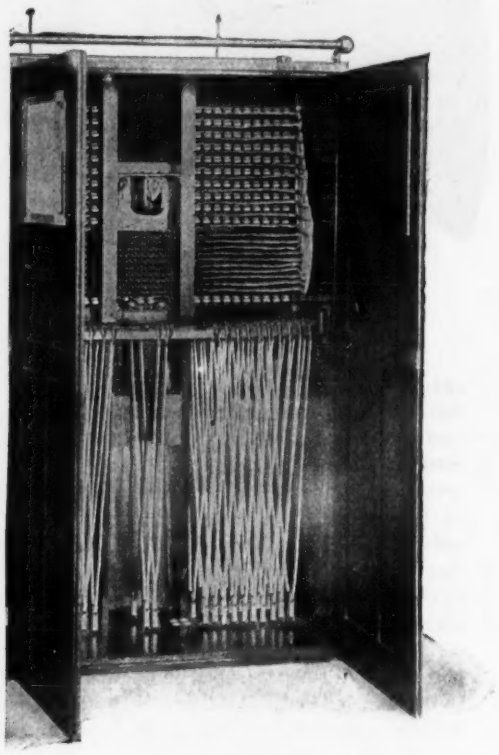


FIG. 2.—REAR VIEW OF ONE SECTION.

The operators' sets are neat and efficient, and the circuits so arranged that each operator can, at will, throw in the relief batteries or switch all the operators' sets together, or in any combination of operators' sets desired. Each operator has a cord test and pilot drop, toll-line facilities, with repeating coils and line test. She also has switches, so that she can cut these in or out at her pleasure; and she can also switch her power and hand generators in and out as desired. These features, together with the lever table switches, and the fact that each operator is at all times within reach of every subscriber in the exchange, add greatly to convenience and economy.

These boards are mounted in beautiful dust-proof cabinets, with all working parts concealed, and all parts accessible by the opening of the doors in the rear or the lifting of the operator's table. Another feature of this apparatus is the efficient protection against lightning and stray currents afforded in the shape of an auxiliary attachment to this board. The lever switches are very strong and efficient, having the best spring metal and platinum contacts. Every spring, contact and connection is accessible, and each switch may be easily removed when necessary. The North Electric Company report that they are working day and night, and will soon have more new specialties to offer in their chosen field.

The Spencer Telephone Transmitter.

An improvement in telephone transmitter construction was recently patented by Mr. James Spencer, of New York. The object of the invention is to avoid metallic vibrations, only the intended actual sound being properly transmitted. To accomplish this result Mr. Spencer employs novel means of supporting the diaphragm. In the instrument illustrated, a sectional view of which is seen in Fig. 2, two diaphragms are shown. Layers of tissue are placed between the diaphragms to prevent induced vibration, and for the same purpose the diaphragms are securely held in place

FIG. 1.—TRANSMITTER COMPLETE.

against rings of wood fibre or other non-conducting material. By this method of construction the metallic sound or ringing which is so common is taken up or deadened by the soft lining materials, thus insuring the proper transmission of the sound of the voice, even in very noisy places. The two diaphragms are held securely in the grip of the frame by a metal ring and stout clamps, and vibrate in unison with the sound waves. At the centre of the diaphragm is clamped a button which faces a second button carried on the frame of the transmitter. The adjacent faces of these two buttons are preferably formed with concentric grooves (see illustration at lower right hand corner of Fig. 2), the portions between the grooves being polished to insure a proper contact. Any material may be placed between the buttons. The two buttons are enclosed in a wrapper of flexible material carbonized to form an auxiliary conductor, the

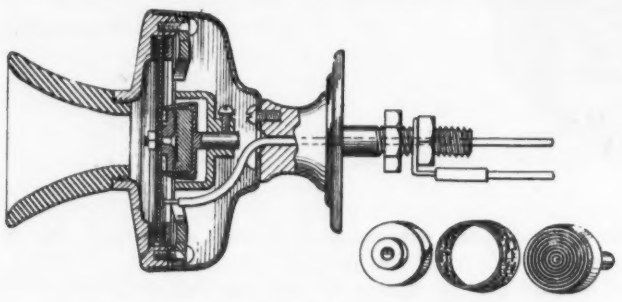


FIG. 2.—SPENCER TRANSMITTER.

wrapper being preferably provided with alternately-arranged slits for breaking the current in a transverse direction.

It is claimed for this transmitter that it will transmit all sound and reproduce it in its natural tone. In the language of the patent specification, it will reproduce a whisper as accurately as the music of a brass band. The Spencer Electrical Company, of New York City, the manufacturers of the apparatus, also state as to the practical, commercial instrument, now being marketed by them, that it is of high grade quality, suitable for working over any distance, and embodies years of experience in this important field of telephone work.

Harvard Lightning Arresters and Fusible Cut-Out.

A simple and effective combined fuse and carbon lightning arrester for telephone circuits is shown herewith in two types. Fig. 1 represents a porcelain single-pole fusible cut-out and carbon lightning

FIG. 1.—LIGHTNING ARRESTER AND CUT-OUT FOR GROUND CIRCUITS.

arrester for common ground circuits, and Fig. 2 a double-pole type for metallic circuits. As will be seen, both are compact in form. The fuse links are held in position by metallic clips and can be easily and quickly replaced. The spark-gap carbons are held firmly in a fixed position and cannot slide out of place so as to make a connection produced a short circuit, and are readily removed for examination. The metal parts are mounted on a substantial porcelain base. All parts are indestructible with the exception of the fuse links, and the cost of replacing these when burned out is merely nominal. A fuse arrester used alone does not afford proper protec-

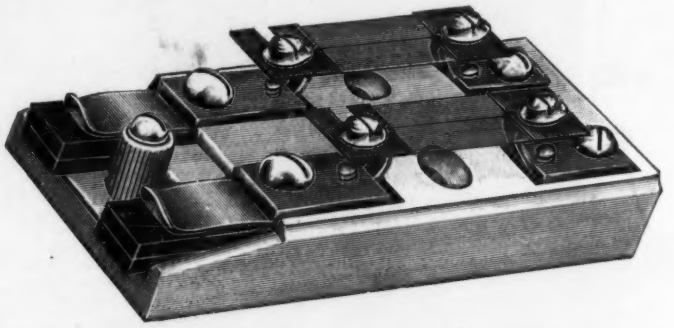


FIG. 2.—LIGHTNING ARRESTER AND CUT-OUT FOR METALLIC CIRCUITS.

tion to sensitive instruments from damage, nor does a lightning arrester when used alone. Their combination, as in this case, does, however, secure such immunity. The instruments illustrated, which are applicable to the switchboards of telephone exchange and toll lines, are made by the Harvard Electric Co., 234 Clinton St., Chicago.

The Woodward Water Wheel Governor.

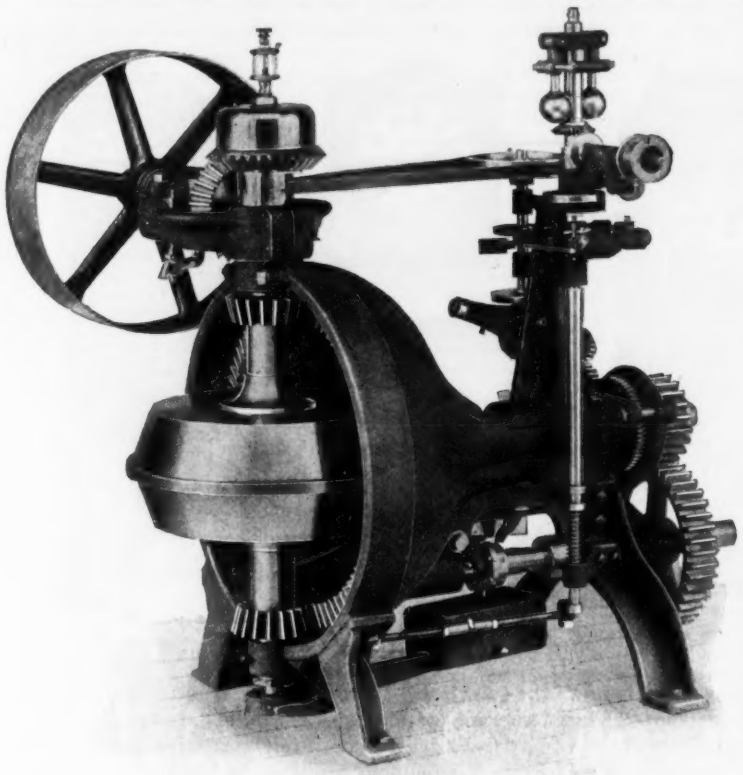
With the widening use of water power for driving electric generating apparatus has arisen a demand for reliable and sensitive water wheel governing mechanism. Owing to the exacting requirements of electrical work the highest mechanical skill has been bestowed upon this important problem with the result that governors may now be found that give very satisfactory results indeed, and are fully guaranteed as to regulation and reliability by manufacturers.

The governor illustrated herewith is of the compensating type and is the latest form manufactured by the Woodward Governor Compay, Rockford, Ill., who have been engaged in this line of engineering for many years. The advantage claimed for it is that it is entirely mechanical in operation and has no electrical or liquid parts.

A brief description of the construction of the governor will enable the reader to better understand its operation and judge of its merits. The inner friction wheel and shaft which revolve continuously, are supported and balanced by a weight so that normally the inner friction wheel does not touch either of the outer wheels. A connecting rod extends from the weight arm to an upright shaft, and when the latter is turned to the right or left the upper or lower friction wheel is engaged. To the top of the rock shaft is hinged a

frame carrying two tappet arms which extend out to a revolving hardened steel cam, one above and one below it. This frame is connected to the rod of the speed governor and moves with it. When the speed is right the tappets are supported so that the cam revolves freely between them. On the lower end of the cam shaft is a friction disk, which rests on a leather faced friction wheel on the diagonal shaft. The hub of the friction wheel is threaded and fits loosely on the diagonal shaft. The constant tendency of the rotating disk is to cause the friction wheel to travel along the shaft to a normal position at the centre of the disk. When the governor moves to open or close the gate, the diagonal shaft, which is geared to it, is turned and the friction wheel is caused to travel along the shaft, away from the centre of the disk, and raise or lower the cam shaft. As soon as the gate movement ceases, the disk causes the friction wheel to gradually return to the centre and the cam shaft to resume its normal position.

When the load increases the first slight drop in the speed causes the lower tappet to be brought up against the cam which forces it outwards, turning the rock shaft and thus positively engages the lower friction wheel. The governor will now open the gate until the tappet is released from the cam. As the gate opens, the friction wheel on the diagonal shaft travels upwards, raises the cam shaft and releases the tappet when the gate has been opened the required amount to restore the speed to the original rate. As the increased supply of water gradually brings the wheel back to the normal speed, the cam is returned to its original position through the action of the rotating disk turning the friction wheel back to a central position.



COMPENSATING TYPE WOODWARD GOVERNOR.

This action of course is reversed when a decrease of load makes it necessary to reduce the gate opening.

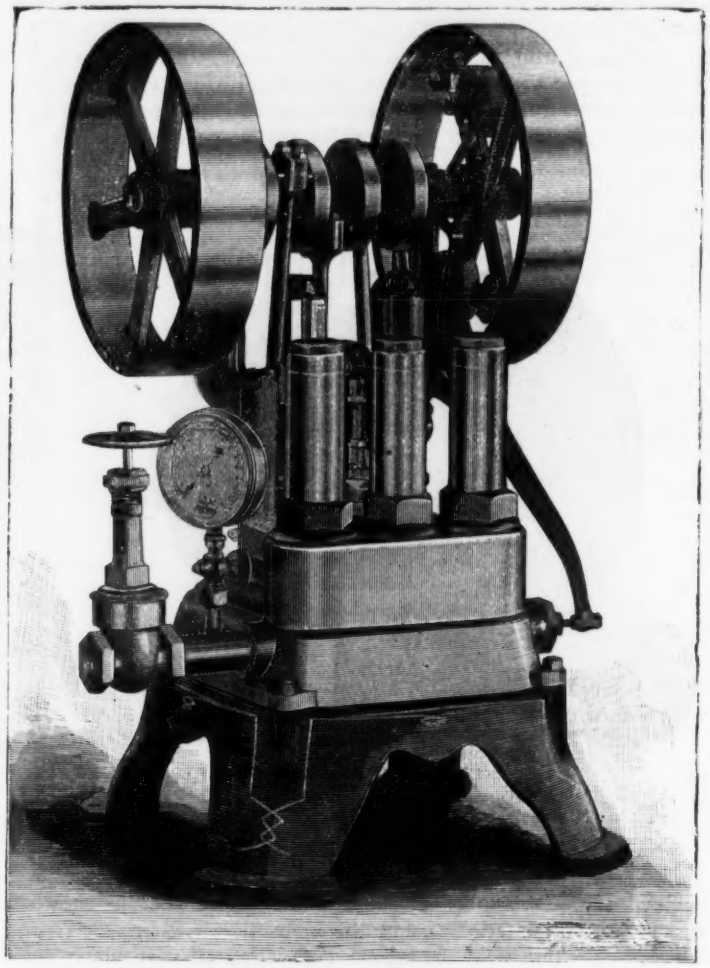
The lag due to the inertia of the water and of the moving parts of the machinery is compensated for by a simple and positive mechanical device which permits the gate to be instantly corrected for any change of load without racing, maintaining the same speed at all stages of the gate. The gate operating mechanism is the same that has been used in this company's standard type governors for the past thirty years. In the quick-acting governors, however, the friction wheels are controlled by a cam acting on tappets, the position of which changes with that of the speed governor. This speed governor has been especially designed for this purpose. Its sensitiveness can be adjusted to any degree desired and, it is stated, it is not affected by the jar of adjacent machines, so that no dash pot is required.

As this governor operates the gate just sufficient to make the proper correction for the load changes, the water wheel gates are not subjected to the unnecessary wear that must result when the gate is kept continually hunting, and the resulting corresponding fluctuations in speed are avoided.

It is stated that several large stations have been using these governors for some time with excellent results.

An Hydraulic Engine.

An interesting type of prime motor is shown in the accompanying illustration, the principles upon which it is based being novel in several respects. As will be seen, it resembles the ordinary reciprocating steam engine in general appearance, but it is actuated by water pressure, and its operation involves the principle of the hydraulic ram, though without the loss of water. By the addition of air chambers and a check valve to each cylinder inlet passage, the momentum of the water stores up pressure which may be two or three times greater than that of the supply mains. During a portion of the stroke this stored pressure is used, and the average pressure in the cylinders may thus be considerably greater than in the supply



JOHNS HYDRAULIC ENGINE.

mains. In consequence of such increase of pressure, the size of machine for a given power is much smaller than other forms of water motors.

The engine has three cylinders, and the same number of cranks at angles of 120 degs. to each other. Each valve has a separate inlet, check valve and air chamber, the check valve being between the inlet and a common supply chamber connected with the water supply pipe. Each cylinder has a piston valve worked by means of a cam arm receiving motion from the piston rod of one of the other cylinders; the motion is such that the valve is quickly opened, held open until the end of stroke, and then quickly closed to the supply and opened to the exhaust. When closed to the supply, the momentum of the checked water gives rise to a pressure which keeps the check valve open, water continues to flow into the inlet and compresses the air in the air chamber. When the valve again opens, the water thus entrapped flows into the cylinder at first under a pressure equal to that in the air chamber, and greater than that of the supply, the

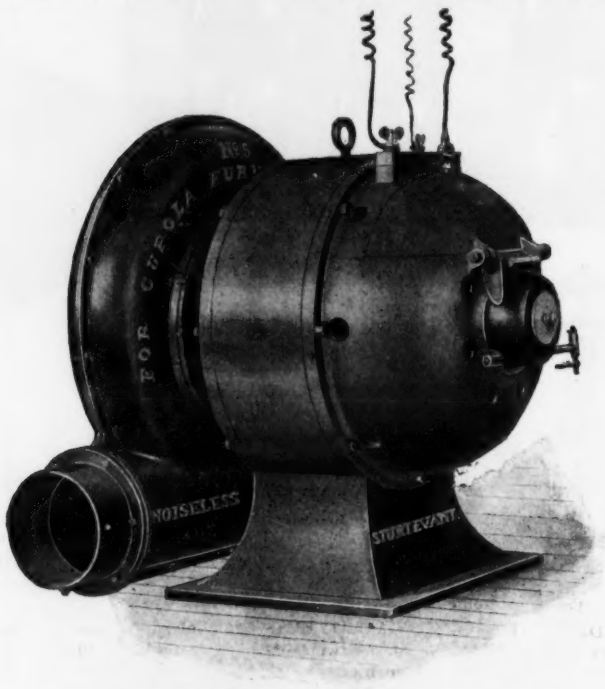
check valve not permit.ing any return flow into the supply chamber. When the pressure on both sides of the check becomes equalized during the latter part of the stroke, connection through the check is again made to the supply chamber, and sufficient water at supply pressure enters to complete the stroke. The same cycle, of course, is repeated at each stroke.

This engine, which is called the "Johns Hydraulic Engine," and made by the Elmira Manufacturing Company, 159 Greenwich Street, New York, is claimed to have a much higher efficiency than any form of turbine wheel or other water motor, and to be particularly suited for running electrical generating machinery.

An Adjustable Type of Steel Pressure Blower with Enclosed Motor.

One of the greatest difficulties in the purchase of fans for various purposes frequently lies in the inability of the purchaser to obtain at short notice a fan having the proper direction of discharge. This difficulty has been obviated in the design herewith presented, which is made by the B. F. Sturtevant Company, of Boston, Mass.

The design includes not only this feature, but that of a direct attached and enclosed motor. This motor consists primarily of a field ring of wrought iron, to the sides of which are bolted hemispherical ends that enclose the same. These ends are provided with lugs, to which the fan is attached. These are so placed that the fan may be swung about the centre to discharge in any given direction. The



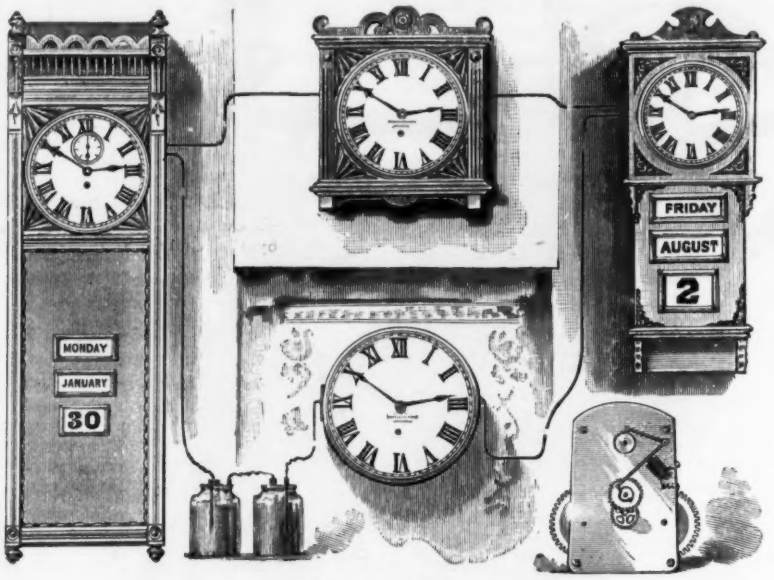
BLOWER DIRECT CONNECTED TO ENCLOSED MOTOR.

outer end of the enclosing case is provided with a door as shown, which renders the interior readily accessible.

The motor within is of the bipolar type, designed particularly for this class of work, and is provided with carbon brushes of the reaction and self-adjusting type. This design is evidently suitable for all positions where dust or moisture is present, and is manifestly desirable when there is any possibility that future conditions may demand a change in direction of discharge.

Prentiss Electric Time System.

We illustrate herewith a system of regulating and synchronizing timepieces which has been patented by The Prentiss Clock Improvement Company, of 49 Dey Street, New York City. This system, which ranks as one of the most improved and at the same time one of the simplest in use to-day, is not strictly an electric clock system, but a system of ordinary clocks synchronizing each hour electrically. The cut shows a plant of four synchronized clocks, two having calendars and two without. The large clock on the left is the master clock and controls the other three clocks. It will be noticed that all the clocks are connected in series, a small battery being inserted in the circuit for operating the synchronizing device each hour. Each of the sub-clocks consists of a real clock running sixty to ninety days on one winding. The method heretofore adopted in synchronizing timepieces has been to use a hand-setting device, the office of the electromagnet being simply to force the hands exactly to the hour in case the clock is a little slow or a little fast. In the Prentiss system the hands are not twisted on their arbors in any way, so that even clocks with second hands may be synchronized as readily as those without. Moreover, tower clocks, time recorders, watchmen's clocks, time stamps and all kinds of registering clocks may be synchronized as easily as an ordinary clock. The sub-clocks are regulated so that they will have a very slight gaining rate. About ten or fifteen seconds before the hour, the master clock closes the circuit and the electromagnets in the different sub-clocks are thereupon energized and their armatures endeavor to respond. As will be seen, however, in the small cut in the lower right hand corner there is a cam on the centre arbor of the clock which may or may not prevent the action of the armature. Should this cam be in such a position as to allow the armature to act, a detent will be drawn down quickly with a tooth disk mounted on the arbor of the escape wheel, and in his way the train of the clock is caused to stand still though the pendulum continues to swing. Should the sub-clock be two or three seconds fast when the master clock indicates correct time, not only will the hands of the sub-clock but the entire train will stand still until this error of two or three seconds has been corrected, when the sub-clock will once more start off exactly with the master clock. Each sub-clock acts independently of the other and is governed by the master clock. While ordinarily a few seconds only may be corrected at the hour, yet as a matter of fact there is no dead point for



THE PRENTISS ELECTRIC TIME SYSTEM.

the minute hand of the sub-clock. In other words, it is always under control of the master clock, and a sub-clock which is twenty-five minutes slow or twenty-five minutes fast if left to itself will eventually come back to correct time without being set by hand.

The great advantage of this system is its simplicity and its very wide range of control. Heretofore, it appears, it has not been possible to synchronize a clock which was more than three of four minutes away from correct time. Should the line become broken or the battery become weak the sub-clocks still continue to run, although of course not under control of the master clock. In this respect, it is claimed, they are vastly superior to the purely electric or minute jump clock, which is a dummy only, and has no capacity for keeping time correct except when connected with a master clock and supplied with electric energy. The amount of battery required to regulate this system is exceedingly small, as the circuit is closed but once an hour, and about one cell per clock is sufficient to operate the synchronizing magnet. It will be noticed that should the master clock need resetting, it is not necessary to go around and set each sub-clock, as these will soon reset themselves to correspond with the master clock. The large number of schools and other large buildings using this system are an evidence of its superior advantages, and wherever it is desirable to control a large number and variety of timepieces from a single centrally located master clock, this would seem to be an ideal system.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—As the summer progresses, the course of the money market becomes more and more interesting, and the tendency of all the bank reserves to a lower point not only acts as a check upon stock speculation, but hints at higher rates for money and is above all a sure indication of commercial activity. In other words, business is a better field for capital to-day than the stock market, and of all the signs of the times, few could be better than this. Moreover, the higher rates for money beget caution, and the bankers have wisely made up their minds that neither stock speculation nor overtrading shall run away with them. We are too near the awful lessons of 1893 to forget the dictates of caution and prudence. Meantime trade conditions are sound and excellent, and give a firmness to all markets. The general soundness is shown by the minimum reached in failures, while another good feature is the fact that the activity reported is not from one section of the country, but is universal. During the past week stocks have appropriately been dull, with a strong undercurrent suggesting a higher scale for the Fall. During the week, 4725 shares of Western Union were traded in, declining to 89¾. General Electric held its recent gains, and on sales of 4235 shares closed at 124. Brooklyn Rapid Transit was heavy, falling off 1⅞ on sales of 155,590 shares, while Manhattan Elevated on 74,561 shares declined to 117⅜, and Metropolitan Street Railway fell off to 208½ on sales of 9342 shares. In Boston, American Bell Telephone closed the week at 346 to 350; Erie 97 to 98; New England, 140 bid; Michigan, 97½ to 100; Mexican, 3⅞. Boston Elevated closed at 108 bid, and West End preferred at 137. In Philadelphia, Electric Storage Battery closed at 155 to 160 for preferred; Pennsylvania Electric Vehicle rose to 15½; Philadelphia Traction was 99¼ bid; Pennsylvania Manufacturing Company, 25 bid; Electric Company of America, 17¼, and General Electric Automobile, 6½ bid. In Chicago, City Railway closed at 102½; Lake Street Elevated, 18; West Chicago Railway Consol 5s. at 106¾, and Metropolitan Elevated 4s. at 96½. Among "outside" securities in New York, Electric Vehicle preferred closed at 115 to 125, and common at 93 to 102; New York Electric Vehicle Transportation at 24⅛, and New England at 10⅛. Electric Boat preferred closed at 45, and common at 12 to 16. Other changes were few and slight.

FINANCIAL PLANS FOR THE UNITED RAILWAYS, ST. LOUIS.—The official financial plans of Brown Bros. & Co., of New York, in connection with the securities to be issued by the United Railways Company, are as follows: The total issue of securities to be authorized by the United Railways Company will amount to $90,000,000. Of this, $45,000,000 will be in first mortgage forty-year gold bonds, bearing 4 per cent. interest. Preferred stock to the amount of $20,000,000 will be authorized, and the amount of common stock to be authorized will be $25,000,000. Of the $45,000,000 in bonds, there are to be reserved $8,000,000 for future betterments, improvements and acquisitions, including the minority stock of the St. Louis Railroad Company, now owned in the National Railway system, and also the $3,000,000 of bonds of the railways in the St. Louis & Suburban system. There are also to be reserved for underlying liens—the bonded indebtedness of the various lines absorbed by the United Railways Company—bonds to the amount of $14,000,000. This will leave $23,000,000 in bonds, which are to be presently paid over to the stockholders of the several constituent railway companies. Of the $20,000,000 in 5 per cent. cumulative preferred stock, there will be reserved $8,435,000 for future acquirements, expenses of consolidation, betterments and improvements. The remainder, $11,565,000, will be issued to the stockholders of the several constituent companies, or, in other words, to the subscribers whose names appear upon the company's books. Of the $25,000,000 in common stock there will be reserved for future requirements, betterments and improvements, the sum of $7,652,500. The remainder, $17,347,500, will be issued in payment to the stockholders of the several constituent companies referred to. The subscribers to the securities are to receive in return for their subscription 99 437-1000ths in bonds, 50 per cent. in preferred stock, and 75 per cent. in common stock, with the condition that they pay $11.25 per share for the common stock. On the basis of a $10,000 subscription, this would mean that the subscriber would receive $9,943 in bonds, fifty shares of preferred stock and 75 shares of common stock at $11.25 per share for his $10,000.

GENERAL ELECTRIC.—A Boston *Herald* financial item says: General Electric people are said to have in mind to recommend an increase in the common stock by and by—say, a $10,000,000 increase, more or less of which would be offered to stockholders at par. The earnings are declared about 21 per cent. on the common stock. The New York News Bureau says: "Although much speculation is afloat as to the causes behind the steady accumulation of General Electric common, which has had the effect of sending the price above 124, no definite explanation has been forthcoming. In one quarter it is said that the buying is upon prospects of an increased dividend. Such a move would be the natural result of the present big earnings of the company, which are reported to run as high as 20 per cent. on the common stock. The first dividend on the common stock was paid last May, at the rate of 6 per cent. per annum. Rumor now has it that the company will hold to this as the regular rate, and will declare extras from time to time as earnings warrant. It is the expectation of these extras that is supposed to be behind the present advance."

SOUTH SHORE & BOSTON STREET RAILWAY.—The Hanover Street Railway has changed its name to South Shore & Boston Street Railway. This road is a consolidation of the Rockland & Abington, the Braintree & Weymouth, the Bridgewater, Whitman & Rockland, the Hingham and the Hanover street railways. The capital stock of the consolidated company is $690,000. The bonded indebtedness, $600,000. The company has 74 miles of track. The earnings of the several roads in 1898 were $214,693, with operating expenses of $165,056, making their income above operating expenses $49,637. It is confidently expected that by the operation of the roads as one system and the operation of the independent line to Brockton now nearly completed, the earnings for 1900 will be increased to $240,000. Operating expenses can be reduced to $140,000. The consolidation was brought about by Messrs. Pepper and Register, of Philadelphia, who are the largest owners of the stock of the new company. The bankers for the syndicate controlling the new company are George A. Fernald & Co.

NEW JERSEY.—Heretofore the impression has been general that the contemplated union of the gas, electric light and trolley interests planned in New Jersey would only take in the companies in the northern end of the state. It is now stated that as soon as the combination in the northern end of the State is completed, steps will be taken to bring the trolley and electric light interests of the other parts of the State into the combination, and that before the end of next year the syndicate will cover the entire State. This report was strengthened last week when it became known that the Mt. Holly Gaslight Company in South Jersey has been secured by a syndicate composed of Col. A. R. Kuser, of Newark; Col. Perrine, of Trenton and John C. Moore, of Philadelphia. They are believed to be acting for the United Gas Improvement Company, which is directly interested in the North New Jersey combine.

NORTH AMERICAN COMPANY.—The following scheme of reorganization has been given out, and has also been denied. The intention is to reduce the present capital of $40,000,000 to $10,000,000 of 4 per cent. preferred and $10,000,000 of common stock. The net revenues of the company from its holdings of the Milwaukee Street Railway and the Edison Electric Company, of Cincinnati, are sufficient to pay the 4 per cent. on the proposed issue of new preferred stock. The underwriters estimate that the preferred stock on a 4 per cent. basis will be worth at least 60, and for its voting right the new common should have a market value of about 10. For each 100 shares of the present stock there will be given 25 shares of preferred and 25 shares of common. At these prices the new stock will bring say $1750, as compared with the present cost of 100 shares of North American stock at $1225.

THE AMERICAN ELECTRIC HEATING CORPORATION has defaulted on its $300,000 outstanding bonds, but as the bonds are all held by friends of the company it will be allowed to continue as it is until the business has been placed upon a paying basis. This company is a consolidation of various electric heating companies, and it owns patents of value relating to electric heating and cooking. It is capitalized for $10,000,000 stock and $1,000,000 bonds, of which only $300,000 are out, but this excessive capitalization will be reduced at the proper time. Among the directors are Charles Francis Adams, Charles E. Perkins, J. Murray Forbes, William Endicott, Jr., and George U. Crocker. The company is now paying its way. It is doing a business, it is said, of about $100,000 per year, and there is a growing demand for the apparatus.

MANHATTAN AND METROPOLITAN.—It is Wall Street expectation that Mr. Gould and Mr. Whitney will conclude abroad all detains of Manhattan-Metropolitan deal. It is stated that one of Mr. Whitney's Metropolitan attorneys sails with Mr. Gould. Incidental to new close relationships between Manhattan and Metropolitan financiers have been recent purchasers of large blocks of Manhattan stock for the account of Metropolitan's controllers, and a Wall street trust company is credited with having received for the Metropolitan people over 50,000 shares of Manhattan stock during the past 60 days. All of this may be true, but it is worth noting that Mr. Whitney does not meet Mr. Gould, but returns home just as the latter sails away for Europe.

DIVIDENDS FOR THE EMPLOYEES.—The Columbus (Ohio) Traction Company has begun sharing profits with its employees. It decided to do so last May. The employees benefited by the plan for the first time this last quarter, when the usual quarterly dividend was paid to stockholders. The latter got 1 per cent. on the par value of their stock, and the former—or those who had served more than a year—got 1 per cent. on their yearly earnings. As those earnings average $650, the average dividend paid to labor was $6.50. This is the equivalent of an average increase in wages of 7 cents a day.

CONSOLIDATION AT BLOOMINGTON, ILL.—A corporation named the Bloomington Gaslight & Electric Co. has been formed by the consolidation of the Citizens' Gaslight & Heating Company, the Citizens' Electric Company, and the Gridley Gas Works. The capital stock is $400,000. It is understood the bulk of the capital is furnished by Chicago men. Morris Ullman is the only Chicago representative who openly figures in the combination. This unites all the lighting plants of Bloomington, with the exception of the Bloomington Electric Company.

LONG ISLAND RAILROAD.—The Board of Railroad Commissioners has assented to the application of William T. Kelly, attorney for the long Island Railroad Company for the board's approval of a unified mortgage of $45,000,000, issued by the company. It includes a reservation of funds amounting to $8,000,000 for contingent or future changes of motive power of the line. That sum is only to be expended when a change is determined upon, subject to the approval of the Railroad Commission.

ILLINOIS TELEPHONE.—A meeting of the Illinois Telephone & Telegraph Company has been called for Aug. 14, when a proposition will be voted on to increase the capital stock from $250,000 to $5,000,000, and to authorize an issue of $5,000,000 4½ per cent. 10-20-year bonds. One-half the stock and bonds will be taken by the underwriting syndicate, while the balance will be held in the treasury.

BOSTON.—The Edison Electric Illuminating Company has been before the Gas and Electric Light Commission to obtain leave to issue $750,000 stock for new needs and work.

Commercial Intelligence.

THE STATE OF TRADE.—The middle of the dull season has now been reached, and while more leaders in business and heads of concerns are away for recreation than at any other time, the turn of the tide is near, and in a couple of weeks the inflow of homecoming will be felt. In spite of an unusual thinning out of the army of industry, trade has continued very active, and on the whole has been quite profitable, while the outlook for the fall could hardly be better. Reports from every quarter are sanguine and cheerful. The results of the closing season in many electrical lines have been excellent. Competent authorities who have been sizing up the situation say that in fan motors, for example, the output has certainly reached 50,000 motors this season. This may seem a high figure, but is confirmed by the fact that before the season opened one of the leading concerns said it expected to sell $300,000 worth of fans. This at $8 to $10 apiece net would mean 30,000 from that factory alone. Belated lots are still finding their way through the shops, and some of the makers think they may "get stuck" with them. The probability is, however, that some will still be installed this year, and the rest ought certainly to be snapped up by shrewd dealers and exporters who know how large a demand is now growing up abroad, all the year around, for these necessities of luxury. Returning to general, larger conditions, it may be noted that bank clearings for last week were $1,596,778,656, or 34.5 per cent. over the same week a year ago; while July failures were below the record for any month on record except May, and failures in trade smaller than in any other month. Scarcity of Bessemer pig caused two steel works at Pittsburg to stop a day or two, and $21.25 to $21.75 was paid for 30,000 tons, with $17.75 for gray forge, and a rise of 50 cents in local coke at Chicago. Orders for plates and structural work are refused at most points. Bar iron is in great demand instead of steel, being $3 to $4 cheaper, and new Eastern mills get all the business they want. Tin was raised by London to the breaking point, 33 cents here being followed by 31½ cents, but copper was firm at 18½ cents for Lake. Lead was quiet at 4.60 cents.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material are from the port of New York for the week ending Aug. 1: Antwerp—84 packages electrical material $3245. British West Indies—15 packages electrical material $2778. British Possessions in Africa—12 packages electrical material $369. British Guiana—9 cases electrical material $350; 3 carriages $810; 7 packages electrical material $23. Brazil—55 packages electrical material $2839; 11 packages electrical machinery $992. Central America—24 packages electrical material $1315. Cuba—4 boxes electrical machinery $82; 30 packages electrical material $970. Dutch West Indies—1 case electrical material $50. Dublin—33 electric cable reels, $9612. Ecuador—6 packages electrical material $80. Glasgow—6 cases electrical material $152. Genoa—12 cases electrical material $1565; 1 case electrical machinery $500. Hamburg—39 cases electrical material, $1999. Hayti—8 packages electrical material $113. Havre—16 cases electrical material $621; 47 cases electrical machinery $10,902. Liverpool—52 cases electrical material $4422; 4 cases electrical machinery $365. London—117 cases electrical material $1830; 21 cases electrical machinery $935. Mexico—12 packages electrical machinery $10,000; 26 packages electrical material $636. Marseilles—20 cases electrical material $233. Nice—58 packages electrical material $14,148. Naples—5 packages electrical material $128. Newfoundland—4 cases electrical material $66. Oporto—19 cases electric motors $2588. British Possessions in Africa—2 cases electrical material $4218. Peru—26 packages electrical material $993. St. Petersburg—6 cases electrical material $185. U. S. of Colombia—11 packages electrical material $342. Vienna—11 packages electrical machinery $3110. Venezuela—421 packages electrical material $1206.

THE RELATIONS OF COPPER AND ALUMINUM.—In various ways the relations of copper and aluminum seem to be changing with the conditions inclining to the side of aluminum on account of the very high price of copper, now up to nearly 19 cents a pound. Aside also from the fact that such a price tends to lessen the copper consumption, there are evidences that the intrinsic merits of aluminum are helping it gain a better place. For example, at the fifth annual convention of the National Jobbing Confectioners' Association, held in Buffalo last week, a series of resolutions was adopted urging the Government to take steps for the immediate substitution of aluminum for copper in the shape of pennies, it being alleged that the copper coins are vehicles of disease and dangerous because of the verdigris formed on them. With regard to the present competition between the two metals, a Boston dealer in metals says: "Two factors have nonplussed me. I cannot understand how it is that I can sell copper wire made of Lake Superior copper at 18½ cents a pound, when everybody in the world is supposed to be clamoring for Lake copper itself at 18½ cents, and it is supposed to cost 1¼ cents per pound to manufacture the copper wire. We are selling this copper wire at 18½ cents and are guaranteeing it 96 per cent. pure copper. A second factor that bothers me is the aluminum competition. In July this year I lost a contract for copper wire because aluminum outbid me, not in price per pound, but in relative efficiency compared with price, and my price for copper wire was 18½ cents. I note that the Northwestern Railroad Company of Chicago has closed a contract for 150,000 pounds of aluminum wire for use as feeders in its third rail system; also that at Orillia, Ont., a power transmission plant at Ragged Rapids, on the Severn River, is being installed, where it is calculated that 2000-hp can be developed, and aluminum instead of copper wire is to be used for the transmission of the power. I also note that the Pittsburg Reduction Company, manufacturers of aluminum, is about to invest $3,000,000 at Shawinigan Falls, Quebec, for the production of aluminum."

WATER POWERS IN SOUTH AMERICA.—A recent memorandum from the United States Treasury calls attention to the opportunities existing for water power apparatus in South America, whither a large quantity has already been sent accompanied by electrical machinery. It says: "One possible, if not probable, development of the near future in certain sections of Central and South America is worthy of consideration, and especially so with reference to the proposed intercontinental railway, since it relates especially to the regions which that line would invade. The possibility of utilizing, with the assistance of modern electrical methods, the enormous quantity of water power now going to waste in the mountain regions of Central America and northern South America is worthy of attention in considering the future possibilities of that section of the continent. The trade winds, sweeping westward across the Atlantic in the equatorial regions, become heavily charged with moisture evaporated from the ocean by the extreme heat of the sun, and, striking the mountain chain stretching southward through Mexico, Central and South America, are forced upward to a cooler atmosphere, where the moisture is condensed into heavy rainfalls, thus feeding the mountain streams and rendering them capable of developing power in great and almost unmeasured quantities. With the facilities which modern electrical methods supply of utilizing, controlling and conveying this power, the development of mining, mechanical and manufacturing industries in that region, where nature is so lavish in her supplies and producing possibilities, may be very great within the near future, and especially so when access shall be obtained by the proposed railway lines which, if present plans are realized, will invade this very section and with lateral lines bring it into communication with the sea." This field is, indeed, worthy of closer study for exploitation than has already been given to it.

ELECTRICAL CREDITS.—Speaking last week of electrical credits, Mr. R. E. Gallaher, of the New York Insulated Wire Company, whose leadership of the movement to purge the trade of irresponsible debtors has been so productive of good results, expressed his belief that the last year had seen a marked improvement, bringing the standard in the electrical field up to that of older branches. "Commercial credit," he said, "is a most delicate thing to deal with, and when a chance word can injure it, great pains have to be taken to prevent the ill effects of an action which, being more or less official, could virtually crush a concern out of existence by closing to it all sources of supply. But the solidarity of the trade has been improved not only in New York, but throughout the country, so that if a firm or individual has no right to get credit, the fact is universally known. There are many incidental advantages, such as a tendency to prevent cutting in prices, a better understanding among those who seek to do business on an honest basis, and such a reduction of losses that not only is the capital of the creditor preserved intact, but his legitimate profits are enhanced." Mr. Gallaher said he had seen very little attempt to use the power of the electrical credit associations for malicious purposes, and that on the whole they were doing most useful work. At such a time of expansion as the present, they were particularly serviceable.

THE STERLING ELECTRIC COMPANY, of Chicago, has just completed the installation of complete exchange equipments for the Danville Telephone Company, of Danville, Ill., and the Mattoon Telephone Company, of Mattoon, Ill. These companies have both rebuilt their plants and moved into new exchange quarters. The equipments are duplicates, consisting of the Sterling metallic tubular drop switchboard, with a capacity for 1200 drops (there being 500 installed), Sterling distributing boards of the same capacity, toll boards, monitors and the Sterling combined cable terminals and protectors. Among the recent users of the Sterling Company's sectional Bell type switchboards (for which the company reports that there is a large demand) are the following: The Nevada Telephone Company, Nevada, Iowa; the Moravia Telephone Company, Moravia, Iowa; the Chillicothe & McArthur Telephone Company, McArthur, Ohio; the Cambridge Mutual Telephone Company, Cambridge, Ill.; the Charleston Telephone Company, Charleston, Ill.; the Montcalm County Telephone Company, Stanton, Mich.; the Valparaiso Telephone Company, Valparaiso, Ind.; the Home Telephone Company, Kentland, Ind.; the Lee County Telephone Company, Earlville, Ill.; the Jo Davis County Telephone Company, Stockton, Warren, Apple River, Scales Mound and Nora, Ill., and the Crowley County Telephone Company, Crowley, La.

AMERICAN FUEL ECONOMIZERS ORDERED.—Among the recent orders received by Broomell, Schmidt & Co., Ltd., York, Pa., manufacturers of the American fuel economizer, are the following: For Hollingsworth & Whitney Company, Waterville, Me., two large economizers, two induced draft fans with 14-foot wheels, direct connected engines, together with about 150,000 pounds of steel smoke breechings, dampers, stacks, etc. Lukens Iron & Steel Company, Coatesville, Pa., two economizers, two induced draft fans with 12-inch wheels and direct connected engines; also about 80,000 pounds of smoke breechings, dampers and connections. Weston Electrical Instrument Company, Newark, N. J., for the power house of their new works at Waverly, two economizers with metallic casing, connections, etc. Vacuum Oil Company, Rochester, N. Y. (third order), one economizer for utilizing waste heat from oil stills. Monterey Electric Light Company, Monterey, Mexico, one economizer complete with metallic casing, induced draft fans, etc. The York Light, Heat & Power Company, York, Pa., have closed a contract with Broomell, Schmidt & Co., Ltd., for two 250-hp American water-tube boilers complete with induced draft fans, settings, etc.

R. D. WOOD & CO., of Philadelphia, are at work installing two new turbines in the station of the Niagara Falls Hydraulic Power & Manufacturing Company, at Niagara Falls. These turbines will be of 2300-hp each, and in their construction there has been a slight change made in the form of the buckets. In the first turbine installed by this company in this station the buckets were oblong, but in these latest machines the buckets are more square. The work is being done under the supervision of Mr. E. H. Broome, who installed the first turbine referred to, and who has a reputation at Niagara Falls of being a very able and experienced engineer in this field of work. All the parts of one of the turbines are on the ground, and parts of the other are coming. It will be some weeks before the new machines are put in operation. The work of installing two new generators in the central station of the Niagara Falls Power Company has commenced. These machines will be known as Nos. 9 and 10, and will bring the output capacity of the station up to 50,000-hp. As is known, no doubt, the machines were made by the Westinghouse Company, and are being installed under the supervision of Mr. R. M. Imley, of Pittsburg.

THE ISOLATED PLANT OUTLOOK is quite bright if viewed from that critical standpoint, the amount of new building projected throughout the country. As a general thing there is about as much lighting and power from isolated plants as there is from central stations, in the larger cities, and very few large buildings go up that do not include an isolated plant in their equipment. At the present moment, in the 20 largest cities of the Union there is on record $135,649,000 of new building projected from January to June, or an increase of 37.4 per cent. over the six months of last year. Of this vast amount,

$84,000,000 is in Greater New York. By no means the whole of this work is carried out at once, but the rate of new developments remains high, and some of the latest work announced, such as the colossal store for Simpson, Crawford & Simpson, in New York City, is an indication of the trend of the times. Even where there is no call for electric lights and motors, there is a large percentage of the newer work requiring electric bells, annunciators, telephones, electric gas lighters, etc., so that the whole electrical trade, manufacturing and retail, is being stimulated by the briskness in building.

BROOKLYN NAVY YARD BIDS.—At Washington, on August 8, the Navy Department opened the bids for the machinery of the Steam Building, which was destroyed by fire last spring. There were a large number of bidders, and it will take several days to determine which of them is the lowest in the several classes and give the details. In electric apparatus, for a complete power plant the three lowest bidders were the Bullock Electric Company, $190,000; the General Electric Company, $180,000, and the Westinghouse Company, $165,000. For the six cranes, the bids ranged from $35,000 to $60,000. Apparently the lowest bidders for the cranes were the Morgan Company, and the Niles Tool Works. For the other apparatus there were 908 bids, ranging from $149,800 to $189,000. Of these the General Electric and the Westinghouse Company put in the lowest. A great deal of interest has been taken in this contract in electrical circles for some time past.

AMERICAN ELECTRIC METER COMPANY.—The works and plant of the American Electric Meter Company, Philadelphia, have been transferred to the Board of Directors by William D. Marks, assignee, and the assignee has been duly discharged by the court. The company, having paid all of its debts and secured a large amount of additional capital, is prepared to take orders for meters for the two and three-wire systems, and to guarantee their operation without calibration by the user. The company has greatly improved its process of manufacture and has, it states, about 2000 meters nearly completed. During the past eight months Prof. Marks has perfected the practical details of manufacture, and he asserts that in the matter of economy of current the meter will be without equal. A feature of this meter is the self-starting pendulum, which only swings when a load is passing.

BOILER PROPOSALS.—Last March we illustrated and described the plans for a proposed huge station for the New York Edison Company, at East Thirty-ninth Street and the East River. They provided for 90,000 rated horse-power and for two tiers of 60 boilers, 30 in each, with coal bunkers for 8000 tons. Specifications have now been sent out to boiler manufacturers, calling for bids on 35,000-hp as a first instalment of this work. It looks as though the plant might be built in the not distant future, although the question has not yet been flatly and finally decided. Meantime, tentative proposals are asked for, the plans are being overhauled and revised, and the matter is being given consideration in other directions. In the original plans, superheating boilers play a prominent part, with engines at an economy of 10 pounds of steam to the horse-power.

THE RUBBER MARKET.—For the first month of the rubber year, which began July 1, 1899, the receipts at Para were 840 tons of Para rubber and 210 tons Caucho, in all 1050 tons as compared with 1114 tons in July, 1898, a decrease of 64 tons, or 5.75 per cent. The world's visible supply of Para and Caucho rubber on July 31 was 2353 tons, as compared with 1464 tons July 31, 1898. The market for crude rubber is very firm, notwithstanding the increase of the visible supply above that of last year, all the factories of rubber goods being actively at work. Up-river fine is quoted at $1.02 for old crop and $1 for new crop. Island, 97@98c. for old crop and 95@96c. for new crop.

EXPORTS AND IMPORTS OF COPPER.—The exports of domestic copper for the fiscal year ending June 30, 1899, were 254,987,079 pounds, valued at $34,476,342. This was 23,969,562 pounds less than in 1898, but the value was $3,400,707 greater. The imports of copper for the fiscal year 1899 were 51,108,228 pounds, valued at $5,604,839, which is an increase over the preceding year in quantity of 386,283 pounds, and in value of $2,527,004. The exports of foreign copper for the year were only 1,516,933 pounds, valued at $76,868, as compared with exports of 22,374,167 pounds, valued at $1,381,197 during the fiscal year 1898.

NEWPORT, R. I.—It is stated that some 60 of the "cottagers" have learned to drive automobiles, that 20 to 30 vehicles have been ordered for private purchase, and that 10 more are being shipped at once to the local depot. It is impossible to supply all the applicants.

Special Correspondence.

NEW YORK NOTES.

New York, Aug. 9, 1899.

THE EDISON ELECTRIC ILLUMINATING COMPANY is to make a $10,000 addition to its one-story brick electric light station on West Fifty-third Street.

TROLLEY ACCIDENTS.—Magistrate Flammer, in the Yorkville Police Court, while conducting the examination of a motorman charged with running down and injuring a woman, said that there ought to be a law making it criminal negligence for a motorman to run down any one on the crosswalks. Motormen are arrested for this but discharged, as there is no law under which they can be punished.

STOPPING STREET CARS.—Another ordinance providing a penalty for neglect to stop street cars promptly when passengers signal for them to stop was introduced in the New York Municipal Council last week by Councilman Ryder. A fine of not less than $10 or more than $25 is provided for violations of the ordinance. The ordinance further provides for the licensing of motormen and gripmen, and regulates the maximum speed of cars at ten miles an hour. The ordinance was referred.

PAY OF BROOKLYN MOTORMEN.—President Rossiter, of the Brooklyn Rapid Transit Company, has issued an order, which went into effect last week, regulating the pay of the motormen and placing them in three grades. Those on the surface cars are in the lowest grade, and get $2 a day; bridge motormen get $2.25; motormen on the elevated roads get $2.50 a day. Under the new order Mr. Rossiter has brought into use the new word "motorneer." The elevated engineers will feel the cut made by the new schedule, as they have been getting $3.50 as locomotive engineers. Probably many engineers will drop out and seek places as regular engineers, thus retaining their membership in the Brotherhood of Locomotive Engineers.

BROOKLYN PIPES.—Twenty-three thousand dollars is being expended at the present time in Brooklyn by the gas companies to replace gas mains that have been made useless by the leaking electric current from the trolley line equipment. The officials of the railroad company were notified of the damage their escaping electricity was doing, and it was suggested that they could be held responsible for the damage done to the property of the gas company. At the same time it was asked if nothing could be done to obviate a like expensive experience in the future. A polite note in reply stated that the railroad company also suffered heavy losses from the escaping electricity, and suggested that the new pipes be very thickly covered with tar before being laid in the ground. Nothing was said as to the responsibility.

NEW YORK TELEPHONE COMPANY.—By the purchase of 22 Cortlandt Street, the New York Telephone Company acquires a plot 22 by 137.4. The company now owns 14 to 22 Cortlandt Street and 13 to 17 Dey Street. These properties combined give a total frontage of 119 feet on Cortlandt Street. It is the intention of the company eventually to secure 9 and 11 Dey Street, if possible, and to erect a large building on the entire site. There are leases on the property secured by the company which have two years to run, and it is said that they cannot be bought. This probably means that no steps toward the erection of the proposed building will be taken until the expiration of these leases. The reported selling price is $185,000. The property belonged for a number of years to the late W. H. Bradford and is now owned by his daughter, Mrs. Grace B. Fairbanks, of Lenox, Mass.

WIRELESS TELEGRAPHY IN NEW YORK HARBOR.—Experiments in wireless telegraphy were begun a few days ago at the United States Lighthouse depot at Tompkinsville, Staten Island, by Mr. William J. Clark, under the direction of Col. David P. Heap, the engineer officer in charge of the Third Lighthouse District. It is thought that wireless telegraphy will be adopted for such use as it is now adapted to in sending messages between lighthouses, lightships and merchant vessels and lighthouse stations. Efforts will be made to send messages from Tompkinsville to Coney Island, and if this experiment succeeds experiments will follow with the Scotland, Sandy Hook and Fire Island lightships, and the Navesink lights, Romer Shoal beacon and other lights about this harbor. Mr. Clark, it is stated, expects to send messages across the 40 miles between the Tompkinsville station and the Fire Island lightship. Col. Heap says that wireless telegraphy may prove of great service to the lighthouse establishment. It would give a means of communication not only between the harbor lights and the station, but between the lights and ships entering or leaving the port.

THE MERCHANTS' ASSOCIATION of New York is arranging for an exhibit of the various manufactured products of this State, to be shown under its auspices in an appropriate building at the Fifty-ninth Annual State Fair, Syracuse, N. Y., during the week of September 4-9, inclusive. Arrangements have been perfected with the railroad companies for transportation of all goods to Syracuse and return, without cost to the exhibitors, together with free transportation for one or more attendants, as may be required. No charge will be made for space occupied in the building to those exhibiting under their auspices; thus, the only cost to intending exhibitors will be the preparation of their exhibits and the expense of attendants during the fair week. For space, or any further information, our readers should address G. W. J. Angell, General Manager Greater New York Exhibit. The Merchants' Association of New York.

NEW DEPARTMENT STORE.—It is stated that Simpson, Crawford & Simpson are soon to have on Sixth avenue one of the finest department stores in the city. In the basement will be the engine room, refrigerating plant and other machinery. Four large boilers will furnish the heat, power and light for the entire building, will run the elevators and fans, pump the water, and furnish the power for the refrigerating plant. The last named, besides supplying ice for the restaurant and for ice water on every floor, will be used for the cold storage room for furs. There will be two groups of four elevators each on each side of the store, besides four elevators for freight and employees, and many dumb waiters for carrying goods from one floor to another. Express elevators will run to the dining rooms. Special attention has been given to ventilation, and there will be both positive and negative systems throughout, by which pure air, properly warmed, will be introduced, and vitiated air expelled by forced draught. The system of electric lighting will be complete and elaborate. The estimated cost of the building is about $1,800,000.

NEW ENGLAND NOTES.

Boston, Mass., Aug. 8, 1899.

THE WYCKOFF CREOSOTING COMPANY, of Williamsport, Pa., are at present enjoying the most amazing success in their creosoted wooden conduits for electrical purposes. They are the oldest company in the business and have established well known systems in the telephone, telegraph, electric light, railway and power fields, having large quantities of their conduit in use in Boston, New York, Philadelphia, Cleveland, Chicago, and, in fact, in almost all of the important cities of the United States and Canada. Mr. Wyckoff, the president of this company, who has for some years made his residence in Stamford, Conn., has made a special study of this field, and is well known to the electrical men in charge of the most important plants, and his judgment relied upon.

MR. SEARS B. CONDIT, who has for so many years been general manager of the L. A. Chase Co., and latterly vice-president of the Chase-Shawmut Company, has resigned his position with that company, in order to go into business for himself. He has opened up an office, storeroom and workshop at 63 Oliver Street, Boston, where he will engage in a general manufacturers' agency business. Mr. Condit has already secured the agency for several specialties which he will announce later, and, in the meantime, will be glad to hear from his numerous friends or see them at his new address.

PHILADELPHIA NOTES.

Philadelphia, Pa., Aug. 8, 1899.

NEW TELEPHONE EXCHANGE.—Preliminary plans and specifications are being prepared for the erection of a stone, brick and steel framed telephone building for the Bell Telephone Company at Allegheny Avenue and Seventeenth Street. The ground for the same has just been purchased, measures 100x100 feet and cost $20,000.

BAUGHER, KURTZ & CO.—This is the new style of the old firm of Baugher, Kurtz & Stewart, of York, Pa., who have recently reorganized their well known business as founders, machinists, tanners, etc. Mr. Stewart has retired and Mr. George U. Wiser has joined the company, while its treasurer, Mr. William Eyster, remains as general manager. They are adding to their works, building a new shop, etc., and are very busy in all the various lines with which their name is familiar. Among their recent shipments was a large turbine water wheel to Barcelona, Spain. It may be mentioned that Mr. John S. Rechard and Mr. Fred G. Gotwald are also members of the firm in its new organization.

WESTERN NEW YORK NOTES.

Buffalo, N. Y., Aug. 5, 1899.

MR. C. K. MARSHALL, formerly superintendent of the Buffalo & Niagara Falls Railway and the Buffalo & Lockport Railway, has been appointed electrical engineer of the International Traction Company.

PAN AMERICAN EXPOSITION.—Mr. Luther Stieringer has been appointed consulting electrical engineer for the Pan American Exposition. Mr. Stieringer held similar appointments from the World's Fair at Chicago and the Trans-Mississippi Exposition at Omaha.

TEMPORARY RECEIVER.—Mr. W. Stanley Bruen has been appointed temporary receiver for the Penn Yan Electric Light & Power Company, of Penn Yan. This receivership is made pending the foreclosure of a mortgage. The action is simply to straighten out matters. The plant will not be shut down.

THE TONAWANDA POWER COMPANY has elected officers as follows: President, Charles A. Sweet, of Buffalo; vice-president, George W. Davenport, of Boston; secretary-treasurer, De Lancey Rankine. George W. Davenport will be general manager. Eventually the old plant will be abandoned and power supplied from the new transformer station in North Tonawanda.

MEETING OF ELECTRICAL CONTRACTORS.—At a recent meeting of the New York state electrical contractors held in Rochester, N. Y., Rudolph Schmidt, of Rochester, was elected president for the ensuing term. The other officers elected were David Cronin, of Syracuse, vice-president; Wells Dygert, Buffalo, secretary; J. C. Stearns, Buffalo, treasurer. The next meeting will be held in Buffalo, Aug. 29.

THE LIMA AND HONEOYE FALLS RAILWAY.—Passenger service has been resumed over the Lima & Honeoye Falls electric road. During the several weeks the plant was shut down it has been entirely remodeled and the old gas engine has been replaced by two Ball automatic 200-hp engines. A new boiler house has been built and in it are two boilers and electrical machinery. Mr. C. T. Whitney is the superintendent and he is greatly improving the plant.

THE INTERNATIONAL TRACTION COMPANY is building five transformer substations, distributed about the city of Buffalo, to utilize Niagara power for the operation of its cars. The stations will be equipped with two 500-hp rotary transformers each. The Cataract & Conduit Company is now laying conduits and drawing in cable to supply power to the substations. Rotary and static transformers and switchboards are ordered from the General Electric Company.

THE NIAGARA GORGE RAILWAY, known as the Great Gorge Route, has ordered a complete equipment of track bonds of Messrs. Mayer and Englund, selling agents of the Protected Railbond Company. The bonds to be used are No. 0000, four inches long between centres with 7/8 inch terminals and will be applied to the under side of the base of the rail with the terminals compressed to fill a countersunk hole so that the upper surface of the rail base shall be left clear and smooth for the joint plate bearing.

Niagara Falls, N. Y., Aug. 5, 1899.

THE MOUNT MORRIS DAM.—The Town Board of Mount Morris has been authorized to proceed with the rebuilding of the Mount Morris dam. This means much to the commercial interests of the locality about Mount Morris. When the dam is completed water power will again be furnished to many establishments, including the Mount Morris Illuminating Co. Twelve other water shares will be open to induce other manufacturers to locate at Mount Morris.

NIAGARA POWER COMPANY'S FLOAT IN A PARADE.—On Monday, July 31, there was an industrial parade in Niagara Falls in connection with the Elks' Fair, and one of the principal floats in line was that of the Niagara Falls Hydraulic Power & Manufacturing Company. This float consisted of a broad platform on a wagon, prettily decorated. In the front was a mast and from it swung arc and incandescent lamps. Running up the interior was a hose, one end of which rested in a tank beneath the platform, while the nozzle was suspended over a water wheel at the rear of the float. A pump operated by hand forced the water from the tank onto the wheel, keeping it moving, and thus demonstrating the power principle. The centre of the float was occupied by the products of the mills on the power company's lands, and at each corner of the platform sat a beautiful young lady. It was pronounced one of the most successful displays in the parade, which was over three miles long. The employees of the Niagara Falls Hydraulic Power & Manufacturing Company naturally feel proud of the success of their conception.

PITTSBURG NOTES.

Pittsburg, Pa., Aug. 5, 1899.

PROF. REGINALD A. FESSENDEN, of the electrical engineering department of the Western Pennsylvania University, of this city, who recently invented an instrument for detecting the flash of a smokeless powder flame, has received an order from the government for 100 of these flash finders. They are to be used in the Philippine Islands.

MR. MORRIS W. MEAD, superintendent of the department of electricity, has gone to New York to purchase some additional apparatus for the fire alarm office of this city. While Mr. Mead did not give any details as to the kind of apparatus he intends to buy, he said that the acquisition thereof would enable the Fire Department to respond to a call from 20 to 30 seconds quicker than it is doing now.

ELECTRICAL MACHINERY FOR PUERTO RICO.—N. J. Mitchell and E. C. Alcop, respectively the secretary-treasurer and the general manager of the Puerto Rico Company, were in this city a few days ago, concluding the final details of a contract with the Westinghouse Electric & Manufacturing Company for electrical machinery to be shipped and operated in Puerto Rico. The Puerto Rico Company is engaged in the industrial development of that island. The company has offices in Philadelphia. Mr. Mitchell was at one time connected with the commercial department of the Westinghouse Company.

A CHARTER was issued at Harrisburg yesterday to the Home Telephone & Electric Company, of Pittsburg, having a capital stock of $100,000. The company proposes to erect telephone lines in Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland counties. It is also proposed to establish a number of exchanges in the city and to act as the suburban service of the Pittsburg & Allegheny Telephone Company. It is stated that the best modern systems are being installed and that the company expects to be all ready for business by the beginning of next year. The directors are Thomas B. Lee, Harry T. Van Ostrand, John S. Scully, Jr., John E. Black and John McD. Lee.

OHIO NOTES.

Cleveland, Ohio, Aug. 7, 1899.

THE SANDUSKY, MILAN & NORWALK TRACTION COMPANY has been incorporated to build an electric railway between Sandusky and Norwalk.

THE COLUMBUS CENTRAL RAILWAY COMPANY, of Columbus, is contemplating equipping its line with storage battery cars. An experimental car is under construction at the company's shops.

PROFIT-SHARING.—Some months ago the Board of Directors of the Columbus Street Railway Company, of Columbus, voted to give a certain per cent. of their profits to their employees. The average earnings per man for the past three months ending July 31 amounted to $150, and the dividend of four per cent. declared Aug. 1 netted each man $6. A few days ago $1800 was divided among the 300 employees.

MR. W. B. COONS, of Findlay, has recently purchased the electric light, gas and street railway plants at Defiance for $16,000. L. W. Pryor, of Cleveland, and Charles H. Dickerman, of Milton, Pa., have bought interests in the purchase and it has been decided to construct a new electric line from Defiance through Evansport to Bryan, a distance of 30 miles. A new company with $400,000 is to be incorporated to push the enterprise.

THE MULTIPLEX REFLECTOR COMPANY, of Cleveland, has been incorporated for $30,000 to manufacture electric headlights and lamps. Several Multiplex headlights have been in use on Cleveland street cars and they have been pronounced the most remarkable illuminators ever produced. Mr. C. E. Schroeder, who is the mechanical man of the company, has an arc headlight for street cars or locomotives which seems very promising.

ELECTRIC RAILWAY FRANCHISE.—Judge Dwyer, A. J. Dwyer and Frank Wagenhals, of Columbus, have applied to the county commissioners of Fairfield County, asking for a franchise to build an electric railway from Columbus to Lancaster. This project has nothing in common with the Columbus, Winchester & Lancaster Traction Company, which was recently incorporated. The promoters claim to have secured rights of way over most of the proposed route.

INDIANA NOTES.

Indianapolis, Ind., Aug. 5, 1899.

POSSIBLE ELECTROLYSIS LITIGATION.—The Marion City Council has taken steps toward bringing an action against the local street railway company to recover damages to water pipes through electrolysis.

A GIFT OF AN ELECTRIC LIGHT PLANT.—Troy, Ind., has granted William Wack a franchise for an electric light plant for that city. Mr. Wack has recently come into a fortune and proposes to erect a plant of the latest improved type and give it to the city.

SALE OF TELEPHONE PLANT.—Captain Allen, of Frankfort, recently purchased the plant of the Muncie Telephone Company for a consideration of $40,000. It is given out that the Central Union Telephone Company is behind the bidder and is the real purchaser.

TELEPHONE PLANT BURNED.—The building and switchboard of the Home Telephone Company, of Richmond, was damaged by fire on July 27. The plant is so badly crippled that no service whatever can be given for a week or more. The company has between 800 and 1000 subscribers.

AN OLD PROJECT REVIVED.—The project to run an electric railway from Albany, in Delaware County, to Pennville and other small towns in the vicinity, has been revived and steps taken to materialize it. A year ago a franchise for such a road was procured, but the project was abandoned.

A NEW FRANCHISE.—The county commissioners of Marion County have granted a 50-year franchise to the Indianapolis, Greenwood & Franklin Street Railway Company to use one mile of the Shelbyville road, on either side of Bean Creek bridge. This gap completes the entire right of way and the road will enter Indianapolis, via Shelby Street and Garfield Park. The franchise will be void unless the road is built by July 1, 1900. The managers say the road will be completed by the holidays.

FRANCHISE TRANSFERRED.—The franchise held by W. W. Huffman, of Anderson, and C. J. Weeks, of Alexandria, for the construction of an electric line to connect Laporte and Michigan City, has been transferred to the Pittsburg syndicate, which owns and operates the lines at South Bend, Elkhart and Goshen. The new owners of the franchise state that work will begin at once and that $150,000 will be expended on the plant. Cars are expected to be running between the two cities by Nov. 30. The line projected to Niles, Mich., has been abandoned.

FACTIONAL STRIFE AT TERRE HAUTE.—The Boston syndicate, which recently came into possession of the street railway and the two electric light plants, is the successful bidder for lighting the streets, for a period of five years from February, 1900. Effort is now making to defeat the bid. It is claimed that there was a pretence only of making the company a home affair by putting Terre Haute men on the directory. The only bid against the company was by a gaslight company. The company's bid is for $11.05 per light more than the present contract calls for. Criticism against the new company has arisen and politics is chargeable with the rise in the price of lights. The tax assessment was fixed at $250,000. The company paid $600,000 for the railway and the two electric light plants. The feeling is that it should have been assessed higher. The cry of monopoly is heard all around.

CHICAGO NOTES.

Chicago, Ill., Aug. 5, 1899.

MR. CHARLES FARR, president of the Farr Telephone Construction & Supply Company, has just returned to Chicago, from an extended cruise on the lakes.

MR. G. G. LUTHY, general manager of the Royal Electric Company, of Peoria, Ill., was a welcome visitor in Chicago last week. He reports that they are running their factory night and day, having been obliged to put on two shifts.

THE ILLINOIS TELEPHONE CONSTRUCTION COMPANY has just been incorporated, with a capital stock of $500,000. According to the papers filed with the Secretary of State, the purposes of the company are the operation of telephone and telegraph exchanges and the manufacture of electrical devices. Plans are on foot for the construction of a new system by the corporation acting under the grant recently given by the Chicago City Council. A. G. Wheeler, Edward J. Judd and Louis J. Behan are the incorporators. The company has already secured rooms in the Rookery Building, with offices adjoining those of the Strowger Automatic Telephone Company. Mr. Wheeler predicted a great future for the new concern, but refused to say when the corporation would take advantage of its charter. "Some legal questions remain to be settled before we go ahead," said he. "Just as soon as these are cleared up there will be no delay by our constructors."

INDEPENDENT TELEPHONY.—Officials of the Illinois Telephone & Telegraph Company are elated over the results during the first twenty-four hours that the public has had a chance to subscribe to an independent telephone company. The blanks and prospectuses sent through the mails to possible subscribers of the company brought back 500 signed contracts from business men, and the number is being increased with every mail. President Wheeler says of the situation: "Our success is far beyond what we had ever hoped for. We have more applications than we can handle, and if the business keeps up at the same average rate we will have more subscribers when we open our exchange next spring than the Chicago Telephone Company has to-day after its years of operation. The automatic feature of our system is going to be popular. 'Prompt, private, perfect' is our motto, and the people are beginning to realize that that is just what we are going to give them. A telephone where you dispense with the operator, saving much time and annoyance, and also one that is absolutely private, is something that has been wanted for a long time. Every one who sees our system in working order here in our offices is charmed with it and wants one immediately."

ST. LOUIS NOTES.

St. Louis, Mo., Aug. 5, 1899.

FORMAL TRANSFER OF RAILWAYS.—A meeting of the stockholders of the Union Depot Railway Company and also of the Grand Avenue Railway Company will be held Aug. 9 to vote upon a proposition to sell and transfer both lines, franchises and other property to the United Railways Company. The meeting will be formal.

AN ELECTRIC RAILWAY PURCHASED.—The St. Louis & Belleville Electric Railway Company, which operates a double track line between East St. Louis and Belleville, purchased, on July 31, the St. Louis, Belleville & Suburban Electric Railway, which also operates a line between the same cities. The consideration was $475,000. The purchase price covers all the franchise and property of the Suburban.

KANSAS CITY, MO.—Benjamin Schnierle, receiver of the Tri-State Telephone Company, has sold at public outcry the property and franchises of the company. The property was bid in by the Missouri & Kansas Telephone Company for $2,310. The new owners, it is understood, have assumed all the obligations of the old company, and will continue the operation of the long distance telephone system with many improvements. The line is to be newly equipped and operated in connection with the other lines belonging to the same company and will be a part of a great system of toll lines covering all parts of Missouri and Kansas.

THE CENTRAL TELEPHONE AND ELECTRIC COMPANY has just received an order for bridging 25 long-distance telephones on 150 miles of line, at Opal, Wyo. It is also having a large trade in the Southwest with independent telephone systems, which are owned by private parties, who have made arrangements with the Bell Telephone Company to rent their transmitters and receivers at a normal charge, and thereby become local agents of the Bell Company and secure long distance connections over the latter's lines. The local exchange remains the installer's individual property. Among the towns which have purchased telephone goods other than transmitters and receivers to be used on Bell lines, are Bowie, Tex., Magnolia, Ark., and Dardanelle, Ark.

TEXAS AND MEXICO NOTES.

Austin, Tex., Aug. 3, 1899.

MR. H. B. ORBAN, an American electrical engineer, proposes to establish a new electric light and power plant in the town of Montemorelos, state of Tamaulipas, Mexico.

AMERICAN APPARATUS FOR MEXICAN MINES.—Several of the larger mines in the Parral District, State of Chihuahua, Mexico, are to be equipped with electric light and power plants. The machinery for these improvements has been ordered from the United States.

ELECTRIC POWER TRANSMISSION IN MEXICO.—The demand for electric power transmission machinery for plantation use is growing in the southern states of Mexico. A large shipment of machinery of this class from New York City was recently received at Vera Cruz, Mexico, consigned to extensive sugar and coffee planters in that state.

TELEPHONE CONSTRUCTION IN MEXICO.—The War Department of Mexico has contracted with the firm of G. & O. Braniff, of the City of Mexico, to furnish the material and to construct all the telephone lines that may be required by that department. This is a very important contract, as the government proposes to build many extensions of military telephone lines throughout the country.

A PECULIAR ACCIDENT happened to the municipal electric light and power plant at Austin, Tex., on the night of July 30. One of the sluice gates gave way, causing a greatly increased volume of water to pour through and upon the turbines. This accelerated the speed of one of the dynamos to such an extent that the belt pulley burst into many pieces. Several pieces were hurled through the roof, and fell in close proximity to crowds of people who were enjoying themselves on board the pleasure boat Ben Hur, on the lake near the power house. The frame of the dynamo was wrecked and the belt torn to pieces.

MEXICO CITY'S FIRST ELECTRIC RAILWAY.—The formal inauguration of the first electric railway to be built in Mexico will take place in the City of Mexico about Sept. 16. The work of converting the Federal District Street Railway Company's system in that city from mule to electric power is making good progress. Most of the material which had been ordered from the United States has arrived. The greater part of the heavy rails from the suburb of Guadaloupe to the limits of the city at Peralville, thence to the Zocalo, and on to the south at the Piedad Gate, and thence to the suburbs of Tacubaya, San Pedro, Mixcoac and San Angelo, are laid, and the erection of the poles for the transmission wires is now in progress.

IMPORTANT MEXICAN WATER POWER CONCESSION.—Mr. Robert Maxwell, a well-known American resident of Mexico, has been granted a concession by the Mexican Government to utilize for motive power the waters of the Blanco River, at a point known as Los Mixos, below the falls of Tuxpango, in the District of Orizaba, State of Vera Cruz. The terms under which this important and valuable concession was granted require that the surveys must begin within six months; the plans for the extensive improvements must be submitted to the Government for approval within twelve months, and the construction of the hydraulic and electric plants must begin within twelve months after the approval of the plans. The plant must be completed and placed in operation within six years. The construction work will be conducted under the supervision of a Government inspector.

PACIFIC COAST NOTES.

San Francisco, Cal., Aug. 3, 1899.

THE SOUTHERN PACIFIC Railroad Company has applied for a franchise for an electric railroad in Berkeley, Cal., North Berkeley being the terminus. It is supposed that the company wishes to substitute electric cars for its local trains to North Berkeley.

THE KURTZ ELECTRIC LIGHTING SYSTEM will be in operation in Woodburn, Ore., by Oct. 1 next. A 30-year franchise has been granted Mr. Kurtz for a light and water plant, the town authorities reserving the right to buy the plant at cost price in three years from the date when it goes into operation.

THE FIRE ALARM AND POLICE TELEGRAPH SYSTEM of San Francisco has been seriously inconvenienced by the discharge of all but one of the line inspectors. This was necessitated by the supervisor's retrenchment of the city's expenses, they having been pledged before their election to run the city within the "Dollar Limit." The Fire Department, also, will be badly crippled.

MR. E. M. FRASER, who invented an electric elevator system that has been in successful operation in San Francisco for two years, recently left for New York City. The Otis Elevator Company appreciated the good points of the new system so thoroughly that Mr. Fraser was offered an electrician's position at the company's factory in Yonkers, with a very flattering salary. It is understood that the business of the Fraser Electric Elevator Company will hereafter be merged with that of the Otis Company.

THE SNOQUALMIE CYCLOIDAL IMPELLER is the formidable title of the water wheel that is driving the generators of the Snoqualmie Falls Power Company's new plant, which is to transmit current to Seattle, Wash. Mr. Thomas T. Johnson, engineer in charge of the generating station, is the inventor of this new departure in hydraulic engineering. It operates smoothly under a head of 270 feet. The motor is very heavy, but an efficiency of 91 per cent. of the theoretical power of the water is claimed. Only six men will be required to operate the 6000-hp plant when it is in good running order.

CANADIAN NOTES.

Ottawa, Ont., Aug. 5, 1899.

THE KOOTENAY ELECTRICAL SUPPLY & CONSTRUCTION COMPANY has offered to supplement the present electric plant and divide the system at Nelson, B. C., into two distinct services, supplying the necessary machinery for $7575.

MR. F. A. HUNTRESS, of Halifax, Nova Scotia, manager of the Halifax Electric Street Railway Company, has recently returned from a trip to the West Indies, where he has been looking over the field, with a view to securing electric street railway franchises.

DEVELOPING WATER POWER IN NEW BRUNSWICK.—Mr. Rice, hydraulic engineer of Dayton, Ohio, is consulting engineer for the Grand Falls Water Power Company, of Grand Falls, New Brunswick. This company proposes to develop the power of the Tobique River, in that province.

DEVELOPING FENELON FALLS.—The Light, Heat & Power Company, of Lindsay, Ont., is contemplating the immediate development of 1000-hp at Fenelon Falls, which will be transmitted to Lindsay, a distance of 14 miles. The hydraulic engineer in charge is Mr. C. H. Mitchell, of Niagara Falls, Canada.

ELECTRIC RAILWAY AT WOODSTOCK.—Dr. S. Lieter Ickes, of the firm of Ickes & Armstrong, electric street railway promoters of Harrisburg, Pa., was again a visitor at the city of Woodstock, Ont., a few days ago, in connection with the project to construct an electric railway between Woodstock and the neighboring towns. It is expected that the first line will be built to Hickson and Embro.

THE TORONTO STREET RAILWAY FRANCHISE.—The 30-year franchise to the Toronto Street Railway Company was granted in 1891. The city, under the terms of the franchise, receives 8 per cent. of the company's receipts, up to $1,000,000, and 10 per cent. of the receipts over and above this amount. Besides this the company pays to the corporation a certain mileage allowance. The city's share of the receipts from the company now amounts to about $164,000 per annum.

THE RAGGED RAPIDS POWER TRANSMISSION.—It is announced that the Royal Electric Company of Montreal, Quebec, has been awarded the contract for the Ragged Rapids power transmission scheme of Orillia, Ont., the original contractors having thrown up the work. The tender of the Royal Electric Company is said to be $71,000. This is $3800 more than the first contract price, but considerable additions have been made. The company undertakes to furnish lighting by Nov. 1 and power by Dec. 1.

THE MONTREAL ELECTRIC STREET RAILWAY is to place an electric pay car in the service, so that the men, instead of receiving their monthly stipend at the company's office, will be paid at the various centres. The new pay car is constructed much on the same principle as the regulation mail car used in many places in the electric street railway service. The car is divided into two compartments. One is merely a passageway through which the person receiving money will pass, entrance being made at one end of car and exit by the other. The other compartment is occupied by paymaster and checker, properly screened and guarded.

General News.

THE TELEGRAPH AND TELEPHONE.

EAGLE POINT, ORE.—A telephone line now connects Eagle Point, Ore. with Central Point.

PHILADELPHIA, PA.—The Chester County Telephone Company will extend its lines to many Montgomery County towns.

CENTREVILLE, TENN.—The Cumberland Telephone Company is making arrangements to establish a local telephone system at this place.

ST. ALBANS, VT.—A franchise has been granted to the New England Telephone & Telegraph Company to locate its poles and wires in the streets and highways of the city.

MARQUETTE, MICH.—Plans have been prepared for the erection of a new telephone exchange in this city, by the Bell Company. It will be of fireproof construction, and two stories high.

MICHIGAN.—Rumor has it that the Michigan Bell Telephone Company and the independent Detroit Telephone Company, have plans for a consolidation. The report has not been confirmed.

OZARK, MO.—The Ozark Telephone Company has put in a telephone system at Lebanon. The company has secured a franchise for Buffalo, Dallas County, and will begin work on a forty-mile toll line, with five stations.

KANSAS CITY, MO.—Work is to begin at once on an extension of the Chicago Telephone line to New Lenox. It is understood that connections are to be made along the route so as to afford telephone facilities for the farmers of that district.

BATTLE CREEK, MICH.—The Michigan Bell Telephone Company bought of Mary J. Roe one of the most valuable business lots on East Main street, and will immediately commence the erection of a brick block in which it will locate its exchange and offices.

PHILADELPHIA, PA.—The Mercer and Erie County independent telephone companies entered into a traffic agreement yesterday, with a view of extending their lines to Pittsburg and Cleveland. The new company will compete with the Bell Telephone Company.

TRAVERSE CITY, MICH.—The new telephone company that was organized last fall under the name of the Northern Michigan Telephone Company, and put in an exchange at Traverse City, was sold on July 25 on a chattel mortgage to W. W. Wheelock. Whether it will be continued or not is a question, as it has been a losing venture from the start.

THE CINCINNATI BELL TELEPHONE directory contains a feature which is worthy of much wider use. It is a numerical list of the telephones, showing, in the order of their numbers, the page in the directory on which any number may be found. The directory is like any other directory, the names being arranged alphabetically, without any reference to the numerical order of their respective instruments.

PLATTSMOUTH, NEB.—The Western Independent Long-Distance Telephone Company has filed articles of incorporation with the Secretary of State. Capital, $100,000; incorporators, Charles C. Parmele, Thomas E. Parmele, Thomas H. Pollock and Thomas H. Ewing. The company will build full copper metallic circuits, its object being to connect the principal cities and towns in Nebraska, Iowa and Missouri.

THE PLATTSMOUTH TELEPHONE COMPANY, which has been doing business as a company since Jan. 1, 1899, has incorporated, with a capital of $50,000. The incorporators are Charles C. Parmele, Thomas E. Parmele and T. H. Pollock. The company will do a general telephone and telegraph business in Cass County, with headquarters at Plattsmouth, Neb. It started originally with 100 telephones; it now has 300 and over 100 miles of toll lines.

FARIBAULT, MINN.—The Citizens' Telephone Company has arranged with the Greene & Western Telephone Company to run its line in connection with the line the latter company intends putting in from Minneapolis and St. Paul. This will be completed in thirty days, and will run from here to Mason City, Ia., where it will connect with about 200 miles more wire. The Citizens' Company hitherto has been a local company only, with no long distance connection.

CINCINNATI, O.—The Muncie telephone plant, built three years ago by Zachariah Holbrook, of Chicago; Dr. Griffith, of Muncie, and others, and which has since been operated in opposition to the Bell Company at a greatly reduced rate of tolls, has been sold to Capt. D. F. Allen and J. H. Hedgecock, of Frankfort. The gentlemen are capitalists interested in the independent telephone at South Bend. This plant represents an expenditure of $45,000, and was sold for $30,000 cash. Superintendent Palmer will remain in charge.

KANSAS CITY, MO.—The Independent Telephone Company has petitioned for a franchise from the Council to do business in Kansas City. The death of George F. Putnam, one of the organizers, caused some delay, but the company has gone on making contracts, to be effective when a franchise shall be granted and a plant built, until it now has 2700 contracts with prospective subscribers. The contracts all run for three years, and are on the following scale: Business telephones, $48 a year; house telephones, $30 a year; group lines, several families on one wire, $18 a year.

WIRELESS IN ALASKA.—A. M. Walker, an operator at Bennett City for the Dominion Telegraph line, has sent to Ottawa for wireless telegraph instruments, to be used between Bennett and Vancouver, 800 miles. The Bennett City station will be located on a mountain peak 5000 feet above the sea level and 2500 feet above Lake Bennett. Dr. A. T. Porter, of Amherst, N. S., and W. A. Anderson, a business man of Bennett City, are publishing legal notices to the effect that they will apply to the next session of the British Columbia Parliament for a franchise to operate a wireless telegraph system between Vancouver and Bennett. They hope to get an exclusive franchise.

ERIE TELEPHONE.—President Glidden, of the Erie Telephone system says that the company is rapidly securing permanent locations for its central exchange systems in the principal cities of its territory. The company already owns 56 lots of land in 32 cities, and now occupies 25 buildings, constructed exclusively for telephone service, with five exceptions. The value of the real estate owned is about $1,200,000. Mr. Glidden says the company has in process of construction 31 buildings and contemplates purchasing six additional lots upon which exchange buildings will be erected. When completed the Erie Company will own 62 buildings located in 39 cities. The real estate is distributed as follows: In the Dakotas, 2; in Minnesota, 7; in Wisconsin, 12; in Michigan, 20; in Cleveland, O., 7; in Arkansas, 3; in Texas, 11; total, 62. The total amount invested in real estate when all the work of this character is completed will be about $2,000,000.

BELL OUTPUT.—By contrast with last year the American Bell Telephone business still continues very heavy, and the number of instruments put into service during the past month was the largest, for a midsummer month, in the history of the company. It is in this season, more than in any other, perhaps, that the telephone service is least needed in business circles, but the business conditions this year are so much better than usual that the falling off in the service has been relatively very light. The instrument output statement for the month ending July 20th, and for the seven months of the fiscal year, to the same date, shows, in detail and comparatively, as below:

	1899.	1898.	Inc.
Gross output	48,873	21,551	27,322
Returned	18,028	10,011	8017
Net	30,845	11,540	19,305
Since Dec. 20th:	1898-99.	1897-98.	Inc.
Gross output	389,899	187,884	202,015
Returned	109,765	83,306	26,459
Net	280,134	104,578	175,566
Total outstanding	1,405,384	1,023,699	381,685

ELECTRIC LIGHT AND POWER.

COLUMBUS, O.—The Shreve Electric Light & Power Company, of Shreve, O., has been incorporated, with a capital stock of $8000.

HARRISBURG, PA.—The franchises of the Harrisburg Electric Company have been formally transferred to the reorganized corporation—the Harrisburg Light, Heat & Power Company.

GLEN'S FALLS, N. Y.—The Delaware & Hudson Company is experimenting with electricity for lighting its cars, and if it proves a success, all the coaches of the road will be fitted up. The electricity is generated by power from the running gear, and is stored in storage batteries underneath the car.

NASHUA, N. H.—The Nashua Light, Heat & Power Company held its annual meeting and elected these officers for the coming year: Directors—Fred W. Esterbrook, James H. Tolles, George E. Anderson, Walter A. Lovering and Frank E. Anderson; F. W. Esterbrook, president; Frank E. Anderson, treasurer, and James H. Tolles, clerk.

COLUMBIA, S. C.—The Columbia Canal Company, with 16,000 developed horse-power, and the Saluda Water Power Company, with 7000 horse-power, have been purchased from their New England owners for $800,000 by W. B. Smith Whaley, of this city, and J. L. Coker, of Darlington, S. C. It is understood the three mills and canal will be consolidated into one company, with $3,000,000 capital. John E. Searles, of New York, is taking active interest in cotton mills here, and he is believed to be backing the canal purchase.

TERRE HAUTE, IND.—The Board of Public Works let the contract for the street lighting to the Street Railway Company, which also owns the two electric plants in the city. The price under the new contract is to be $75 per light of 2000-cp, all-night schedule. This is $11.05 more than the present contract, but it is generally conceded that it is a fair price, because it is below the average price in cities which are lighted by contract. It is understood that the company will build a power house on the banks of the Wabash, where will be consolidated the two electric lighting plants and the street railway power plant.

THE ELECTRIC RAILWAY.

EASTON, PA.—The Easton Consolidated Electric Company secured the right of way for a trolley extension through Freemansburg.

FAIRFIELD, ME.—The Railroad Commissioners have approved of the plans and location of the extension of the Benton & Fairfield Street Railway.

PHILADELPHIA, PA.—The Union Traction Company has met the public demand by placing red lights on the rear end of its Willow Grove cars.

WASHINGTON, D. C.—The Potomac & Severn Electric Railway Company has been granted the right of way over several of the streets of Annapolis.

DOWNINGTON, PA.—Efforts are being made to secure the extension of the Philadelphia & Westchester Traction Company's lines through this city.

MONCTON, N. B.—The street railway company has plans prepared for extensions to its system and the establishment of a park on the outskirts of the city.

COLUMBUS, O.—The Columbus Street Railway Company reports net earnings for July increased 119 per cent., and for the seven months increased 45 per cent.

FORT WAYNE, IND.—Mr. H. C. Rockhill has been appointed receiver to conduct the sale of the Fort Wayne Consolidated Street Railway Company. No date of sale is named.

THE BOSTON, MILTON & BROCKTON STREET RAILWAY COMPANY has been authorized by the Railroad Commissioners to issue $40,000 additional stock and $100,000 bonds.

ATLANTA, GA.—The Atlanta Railway & Power Company contemplates the erection of a power house to cost $750,000. Power will be furnished for the Consolidated trolley lines, and other purposes.

HUNTSVILLE, ALA.—The incorporation papers of the Huntsville Railway, Light & Power Company were filed in the Probate Court, all of the capital stock of both companies having been subscribed.

DETROIT, MICH.—Mandamus proceedings will shortly be commenced against the Detroit Citizens' and the Fort Wayne & Belle Isle Railway Companies to test their right to operate their roads on a straight five-cent fare basis.

DETROIT, MICH.—The Port Huron & Port Austin Electric Railway Company has been incorporated to construct and operate street railways. Capital, $25,000. Incorporators: M. A. McCarron, F. H. Cranford, Detroit; F. T. Sinclair, Port Austin.

CORPORATION PERFECTED.—Articles of incorporation were filed on July 17, with the Secretary of State, by the Indianapolis & Martinsville Traction Company, of Indianapolis. Capital, $500,000, with P. H. Fitzgerald, S. R. Holt, J. C. Tarkington, Frederick Joss, and Joseph T. Elliott, Jr., as stockholders.

NEW HAVEN, CONN.—It is stated that the New York, New Haven & Hartford Railway Company is now laying plans to convert the old steam road from Berlin and Meriden to Middletown into a third-rail electric system. Plans have been under way for months to make of Derby and Ansonia, Conn., the centres of an extensive State third-rail system.

GARDNER, MASS.—The selectmen of Gardner have granted to the Gardner & Templeton Street Railway Company a franchise to lay its tracks from the Templeton town line to West Gardner Square. The franchise provides that no railroad or railway freight car shall be carried or handled over the part of the road between Parker mill crossing and West Gardner Square.

GLENS FALLS, N. Y.—The annual meeting of the Glens Falls, Sandy Hill & Fort Edward Street Railroad Company was held recently, when the following officers were re-elected by the directors as follows: J. M. Coolidge, president; Loren Allen, vice-president; F. F. Pruyn, secretary and treasurer. Owing to the expense of paving the usual quarterly dividend was not declared.

KANSAS CITY, MO.—The upper house of the council on July 17 granted the Metropolitan Street Railway Company three new franchises, all for the West and South sides. In the lower house they were referred to the Streets, Alleys and Grades Committee. In exchange for the privileges the company has voluntarily offered to give the city two per cent. of the gross receipts of all business originating on the new lines.

WASHINGTON, D. C.—The Stevens syndicate, as the capitalists controlling the Washington Traction & Electric Company are popularly called, has secured another suburban feeder for its extensive city system of street and suburban railroads. Some time ago an option was obtained by Mr. O. T. Crosby on the Kensington & Chevy Chase Railroad, running between the two Maryland towns named, and hitherto a substantial feeder of the Capital Traction Company's Chevy Chase branch.

KEOKUK, IA.—A project is on foot to build an electric road between this city and Peoria, Ill. James H. Anderson, acting as attorney for J. C. Hubinger, has already secured options on the right-of-way from many Hancock and McDonough County property owners. It is possible that the water power of the Des Moines Rapids at this point will be developed to furnish power for the railroad. The plan includes branch lines to all important places not on the direct line. Franchises will be asked from the Hamilton and Carthage Councils.

JAMAICA, L. I., N. Y.—The Department of Public Buildings, Lighting and Supplies of the Borough of Queens has issued permits to the New York & North Shore Railroad Company, a kindred organization to the New York & Queens County Railroad Company, to erect poles and string wires along the line of its proposed route, in the towns of Flushing and Jamaica. This line will furnish the people of Flushing with a direct line to Rockaway Beach for a twenty-cent fare and a chance for a quick connection with the Brooklyn shopping district on Fulton street by the line of the Long Island Railroad.

ROCKVILLE, MD.—A charter has been granted to the Silver Spring & Sandy Spring Railroad Company for passenger and freight traffic, as well as electric light and telephone communication between the two points in Montgomery County. The amount of capital stock is $50,000, with power to increase it to $200,000 within six months. The incorporators are Warren Choate, of Rockville; Alexander T. Hensey, of Washington, and Henry Nichols, Allan Fres and W. P. Springer, of Silver Spring. The road, it is said, will be built with New York capital, and the electric power will be obtained from either the Brightwood division of the City & Suburban Road, or developed by water power at Burnt Mills.

TOLEDO, OHIO.—The Toledo & Adrian Electric Railroad Company has organized and elected the following-named officers: President, I. E. Kniseley, of Toledo; vice-president, Fred W. Hayes, Detroit; treasurer, Alexander Smith, Toledo; secretary, George H. Beckwith, Toledo; general manager, Lester F. French, Detroit. The right of way for the entire road has been secured, except an entrance to Toledo, and that has been asked for. The cars will probably come into Toledo over the Toledo Traction Company tracks, and a terminal and station will be put up for passengers. The contract will be let this month for the road work and power house. The latter will be located at Sylvania. It is understood that there will be little difficulty in getting a Toledo entrance.

CHICAGO, ILL.—The Chicago, Milwaukee & St. Paul Railway Company has discontinued its suburban service north of its Evanston station at Davis street. This was by agreement with the Chicago & Milwaukee Electric Railway Company, which may complete its line from Milwaukee to Evanston in the near future. The Chicago & Milwaukee will transfer passengers from north of Evanston to the Chicago, Milwaukee & St. Paul at Evanston, and may enter the city at the same rate as formerly. President Miller, of the Chicago, Milwaukee & St. Paul, says there is no special significance in the charge. It is merely desired, he says, to provide better service for the district south of Davis street, and he thinks the connection of Milwaukee and Chicago by an electric line is in the dim and distant future.

THE AUTOMOBILE.

THE DAVIS AUTOMOBILE, which started some weeks ago from New York for San Francisco, has barely yet reached the borders of this State.

THORNYCROFTS.—The great English torpedo boat firm of Thornycrofts has gone into the automobile business in England, believing there is big money in it.

AUTOS IN GERMANY.—The first automobile club of Germany has just been organized. The Duke of Ratibor is its president, and Prince Hohenlohe and Count von Schonbom are vice-presidents. A number of the highest aristocracy are members.

WOODS MOTOR VEHICLE COMPANY, or, as it is generally known, the Fischer Equipment Company, is being reorganized for extensive development, with leading Canadians and New Yorkers in control. One of its hansoms has been frequently seen of late on New York streets.

THE PHILADELPHIA MOTOR CARRIAGE COMPANY has been incorporated in Philadelphia. It will carry on a business of buying, selling and dealing in vehicles propelled by electricity, etc. Capital, $1,000,000. Incorporators, C. P. King, of Philadelphia, Pa.; J. T. McGraw, C. R. Durbin, F. H. Treat, Claude S. Jarvies, all of Grafton, W. Va.

LANCASTER MOTOR COMPANY.—At Trenton, N. J., on Aug. 2, the Lancaster Motor Company, with a capital of $5,000,000, filed papers of incorporation. The incorporators are Percy C. Hamilton, Pittsburg; George S. Stidwell, T. Reginald Horley, and Byron Traver, New York City, and Joseph V. Clark, Jersey City. The purpose of the company is to control the American patent of Frederick William Lancaster, of England.

AUTOMOBILE DELIVERY WAGONS IN BROOKLYN.—Messrs. Abraham & Strauss, a dry goods firm of Brooklyn Borough, New York City, have within the past few days inaugurated a horseless vehicle delivery service. The vehicles are driven by electric power, and are capable of sustaining a speed of ten miles an hour. They have a carrying capacity of 1250 pounds. They are 9 feet long and 6 feet 6 inches wide. The front wheels are 32 inches in diameter, and the rear 42 inches in diameter, with wooden spokes and solid rubber tires.

CHATTANOOGA, TENN.—A $500,000 company has been organized at Chattanooga, mostly with Pennsylvania capital, to manufacture automobiles. The Harding Manufacturing Company, of Nashville, making agricultural implements, and capitalized at $75,000, will be consolidated with the new enterprise. This will be the first automobile factory started south of the Ohio River, and the outlook for it is bright. The company will give employment to 350 mechanics. Mayor Edward Watkins, of Chattanooga, has donated a large tract of land to the company.

DEMAND FOR AUTOMOBILE DRIVERS IN LONDON.—It is stated that much of the ill-luck of the Electric Cab Company in London, in maintaining its automobile service, is due to the fact that its drivers are hired by society automobile enthusiasts, who pay the men higher wages than the company pays. Society people watch for good men plying for hire in the streets, and offer them tempting wages. Some are given as much as $15 a week, and off they go. After all the trouble of training drivers, no sooner are they seen on the streets than somebody snaps them up as private coachmen. Many of these are old hansom drivers, and the company is left absolutely without a man to drive its machines.

NEW ENGLAND ELECTRIC VEHICLE.—Delay in obtaining structural iron has interfered somewhat with the plans of the New England Electric Vehicle Transportation Company. Construction work on its building, sufficient to make it habitable, is not now expected to be completed inside of a month, and until then the company will not increase its equipment of vehicles in Boston. Newport will this year be the principal scene of its operations. The company has 20 vehicles in operation there, and will have 10 more within two weeks. The company rents to customers these machines at $150 per month and cannot obtain sufficient vehicles to supply the demand. The ten machines which are to be added to its Newport equipment have already been leased for the season.

NEW JERSEY.—The New Jersey Electric Vehicle Transportation Company has filed papers with the Secretary of State of New Jersey increasing its capital stock from $100,000 to $1,200,000. This is one of the branch concerns organized by the Electric Vehicle Company. James E. Hayes, the president of the New Jersey Company, who filed the papers in person at the Secretary of State's office, said the company would soon have automobiles in operation in the larger cities and towns and at the seaside resorts in New Jersey. The company will make connection from New York to Philadelphia. Mr. H. McL. Lloyd, of the parent electric vehicle company, is operating a combination electric vehicle and electric plant at Seabright on a small scale, but with most gratifying results.

A LONG RUN.—Manned by Elwood Haynes and E. L. Apperson, an automobile phaeton arrived in New York City from Kokomo, Ind., at a quarter past four o'clock p. m. on Aug. 5, after having made the longest automobile trip on record in the United States. The distance, approximately that of 1050 miles, was made in twenty days, although no effort was made to attain the highest speed of the machine. Aside from two punctures, which occasioned considerable delay, there were no accidents, and the mechanism of the carriage operated in a satisfactory manner. Mr. Haynes is president of the Haynes-Apperson Company, of Kokomo, by which concern the machine was built. The machine is a doctor's phaeton, with seats for two, covered by an ordinary buggy hood. It weighs 1500 pounds, and is operated by a double cylindered gasoline motor of five and three-quarters horsepower.

THE CLEVELAND AUTOMOBILE COMPANY, of Cleveland, with a capital of $500,000, is soon to be incorporated, with Col. B. Hart as president. The company has acquired the large building in the heart of the city formerly occupied by the Cleveland Athletic Club and it is to be used as a factory, riding school and automobile club house. The club idea is to introduce the practicability of the automobile to the public. The riding school is to be equipped similar to that conducted by M. Charron in Paris, and will have dummy figures of foot passengers distributed about the floors in order that pupils may learn to handle a carriage perfectly before they are allowed on the streets. A portion of the building will be fitted up as a club and the vehicles of club members will be taken care of and batteries charged while they wait. The company will manufacture electric carriages and will make a business of renting them.

AUTOMOBILES IN INDIANAPOLIS.—The real fad among the wealthy at Indianapolis this summer is the automobile. Last summer only one of the vehicles made its appearance on the streets, but this summer a score or more excite the wonder and interest of the people because of the different designs and character. The number for both business and pleasure are increasing every day. Society women are among the devotees of the "runabouts," and livery men realize they must be kept for hire instead of horses. The Indiana Bicycle Company is overcrowded with orders and a dozen other manufacturers are turning attention to the production of these vehicles in order to supply the mand. Indianapolis is peculiarly adapted to the use of the automobile and their practicability and popularity are insured. Many retail bicycle dealers are engaging in their sale and they are placed as readily as they can be procured.

AUTOMOBILES FOR MAIL DELIVERY.—A Washington despatch states that with a view of testing the value of automobiles for the collection and delivery of mail, the Post Office Department has authorized William G. Edens, an assistant superintendent of the Free Delivery Division, who has been investigating this subject, to make a proposition to an Indiana firm of automobile manufacturers to equip the office at Alexandria, Ind. Free delivery is to be established at Alexandria, and it is proposed that the company shall put in service there sufficient automobiles to enable the carriers to perform all the work of collecting and delivering the mail by their aid, so as to demonstrate whether or not the service can be more quickly and more satisfactorily performed by the use of these machines. If the test proves satisfactory a number of the machines may be purchased. Arrangements are being made for a test of an automobile mail-collecting wagon in this city. It will not have room for clerks, as the large wagon in service has, but will be used simply to collect the mail from the letter boxes and deliver it at the city post office, as is now done by the carriers in their wagons.

PERSONAL.

W. H. MEADOWCROFT.

MR. W. H. MEADOWCROFT.—So long has been the connection of this gentleman with the General Electric Company, and its predecessors, the news that he has severed his relations with it, gives a shock. The announcement of his intention was given in our pages last week, and the change has now been made. Mr. William H. Meadowcroft came to the United States from Manchester, England, in 1875. Prior to his departure from his native city he had been employed in a law office. Shortly after coming to America he entered the law office of Carter & Eaton, at 346 Broadway, New York, and remained with that firm and its successors over five years. While there he studied law, and was admitted to the New York Bar in May, 1881. Major S. B. Eaton, of the above law firm, had accepted the vice-presidency of the Edison Electric Light Company early in that year, and Mr. Meadowcroft left the legal profession after being admitted to the bar, and became assistant and secretary to Major Eaton in May, 1881, continuing in that position about four years. Mr. Meadowcroft has continued his association with the Edison Electric Light Company and its successors over 18 years. He has been engaged in various departments of the companies, including two years spent in the legal department. During the last six and a half years he has devoted his time to the miniature and decorative lamp business of the General Electric Company, a branch of the incandescent lamp department that was started by him in 1885. Mr. Meadowcroft has also taken an active part in the development of the Röntgen ray business of the company. In the last eighteen years Mr. Meadowcroft has witnessed and taken part in the growth of a wonderful business, and having been engaged in the early struggles of the parent Edison Companies, has been closely identified with the electric lighting industry. In the early eighties he took a very active part in the work of the Edison Electric Illuminating Company, the Edison European Company and the Edison Ore Milling Company, as well as in the various standardizing and other technical committees that were organized in those days for operating the practical part of the business. He also wrote the first commercial pamphlet on incandescent lighting that was published in this country, and prepared all the catalogues of the Edison Companies up to 1884, as well as a number of booklets that were published in 1888 and 1889, and also some other special catalogues in later years. His popular manuals have sold probably better than any others of their kind, such as the "A B C of Electricity," which has run through edition after edition, like any fashionable novel, and is still in great demand. A farewell banquet was tendered to Mr. Meadowcroft by his friends and associates in the Edison Lamp Works at Harrison. He made a very graceful speech, in which he expressed his regrets at parting from them.

MR. W. C. WHITNEY returned home from Europe this week by one of the German steamers.

MR. G. MARCONI, it is now stated, will not come to this country during the fall, as originally planned early in the year. He is too busy.

MR. H. McL. HARDING has returned to New York City after a prolonged vacation on the Maine coast, where he is building a seaside summer home.

MR. GEORGE CUTTING, a member of a well known firm of electrical manufacturers at Derby, England, has returned home after a very satisfactory trip through this country on business and recreation.

MR. LOUIS J. STEELE, chief electrician of Verity's Limited, is in this country on an engineering trip and has also thrown in a little excursion to the Alaskan glaciers just to cool off during the hot spell.

MR. WILLIAM L. ELKINS, who is at the head of the great syndicate controlling the street railway and gas privileges of a large number of cities, began life as an errand boy in a grocer's store. Mr. Elkins is a native of West Virginia, and was born in 1832.

PROF. F. B. CROCKER, of Columbia University, has returned home safe and well after a ten months' trip around the world. Some of his experiences and observations have already been recorded in these pages. He had but ten wet days on the whole trip. His last stay, in England, was but brief.

MR. ARTHUR WARREN, to whose skilled journalistic hand may be attributed much of the clever work done recently in the international press as to Westinghouse plans, projects and big orders, has returned home and gone up to his hotel on the coast of Maine for a week or two of well earned rest and decided change of occupation.

MR. E. E. WOODWARD, of the Woodward Governor Company, Rockford, Ill., has been making a trip through the East with good results. He was in New York last week and reported that the general interest in water power and the activity in manufacture had created a good market for their new types of friction water wheel governors.

PROF. F. A. WEIHE, M.E., Ph. D., of the department of physics and electrical engineering at the North Carolina College of Agriculture and Mechanic Arts, Raleigh, N. C., is spending his vacation inspecting plants, power houses, new processes, etc., in the vicinity of New York. He regards the outlook for new electrical work in the South as very bright.

MR. W. K. DUNLAP.—It is intimated at Niagara Falls that Mr. W. K. Dunlap, who for several years has ably represented the Westinghouse Company at Niagara Falls, is soon to leave for Paris, where, it is said, he will represent the Westinghouse people at the great exposition next year. The climate of the locality does not agree with Mr. Dunlap's health, and, following his recent European trip, he has been reluctant about again settling at the Falls.

MR. NEWTON HARRISON.—While experimenting with caustic soda in a liquid state, Messrs. Newton Harrison, editor of *The Electrical Age*, and Mr. Dana Dwight Book, were severely burnt on face and hands by a terriffic explosion in the office of *The Electrical Age* on Wednesday evening, August 2. The explosion was probably caused by confined gases, suddenly mixed with superheated steam causing an inner vessel to be projected vertically with great force. The sight of both experimenters would have been destroyed, if they had not worn glasses. They are both doing well and are being rapidly provided with a new epidermis. This is the first accident which has occurred to either gentleman during a course of ten years' experimental work.

MR. P. C. BURNS.—A special despatch from Chicago, of Aug. 5, says: "Violation of the State law against using the National flag for advertising purposes is the charge on which P. C. Burns, president of the American Electric Telephone Company, at No. 171 Canal street, was arrested to-day. The case will come up for a hearing on Monday. The complainant is J. G. Nolan, of No. 166 Laflin street. The use of the flag on letter heads, envelopes and in newspaper advertisements was the evidence on which Mr. Nolan based his warrant. 'As soon as we use up these stamped envelopes bearing the flag we will order something different,' said Mr. Burns. 'The red, white and blue shield device, to which objection has also been made, is not a representation of the flag, in my opinion.'"

MR. H. H. VREELAND.—The heads of all the departments of the Metropolitan Street Railway Company have been invited by President H. H. Vreeland to a clambake, which he proposes giving near his farm, near Brewster, on Saturday. After the clambake a reception will be held in Mr. Vreeland's house. Most liberal arrangements are being made for the enjoyment of the visitors, but Mr. Vreeland is anxious that the notion shall not get abroad that the clambake is anything in the nature of a jollification over the victory which the company gained in the recent strike. It is intended solely as an opportunity for the men to enjoy a day in the country. The guests will leave the Grand Central Station at 9 o'clock Saturday morning on a special train to Brewster. The clambake, which will be of the old fashioned Rhode Island kind, will be given in the grounds of the Tonetta Outing Club. Afterward the guests will go to Mr. Vreeland's house, which is not far away, and there they will spend the rest of the day, returning to the city about 7 o'clock.

OBITUARY.

MR. OTTO F. ROTH, of the Salt Lake & Ogden Gas & Electric Light Company, died at Ogden, Utah, July 19. He was formerly in the employ of the Laclede Gas Company, and the Laclede Light & Power Company, of St. Louis, Mo.

MR. LEMUEL WRIGHT SERRELL died last week at his home in Plainfield, N. J., from paralysis. He was born in London seventy years ago. In 1831, father and son came to America and settled in New York, where the elder Serrell practiced as a patent lawyer. The son succeeded his father on the latter's death. In 1871 Mr. Serrell moved to Plainfield. He was elected on the Republican ticket to the Common Council for two terms, and was also a member of the Plainfield Board of Health for several years. In the Civil War he served for two years as 1st Lieutenant in Company F, Thirteenth Regiment, United States Volunteers. He leaves five children. He took out many of Mr. Edison's earlier patents. His son, L. W. Serrell, Jr., is a well-known electrical and mechanical engineer, practicing his profession in New York City.

Trade and Industrial Notes.

THE TAYLOR ELECTRICAL SWITCH COMPANY'S plant will be removed from Chillicothe to New York City.

THE WILMINGTON ELECTRIC PLATING COMPANY has been organized in Wilmington, Del., with a capital stock of $25,000.

THE GROSS ELECTRICAL EXPERIMENTING COMPANY, of Chicago, certified to an increase in capital stock from $12,000 to $15,000.

ACETYLENE GAS BURNER.—The Steward acetylene gas burner shown in our issue of July 29 has just been covered by a United States patent, dated July 25, No. 629,623, issued to Mr. D. M. Steward, of Chattanooga, Tenn.

THE HATCH ACCUMULATOR COMPANY has been organized at Kittery, Me., to manufacture and deal in electrical supplies. Capital, $1,000,000. Incorporators, G. E. Hatch, of Quincy; J. Middleby, Jr., of Malden, Mass.

THE CUTTER COMPANY, Philadelphia, Pa., has just issued a neat little pamphlet on its C-T switches—single pole, double pole, three-wire, four-wire, interior and automatic. C-S wood mats and C-S iron wall-boxes are also listed.

THE SOUTHERN ELECTRO-CHEMICAL COMPANY has been organized at Baltimore, Md., to carry on a general chemical business. Capital, $1,000,000. Incorporators: R. M. Glacken, O. J. Fisher, R. B. Dungan, J. S. Warden, J. W. Stuart, all of Baltimore.

THE CLARK ELECTRICAL COMPANY has been organized, with its principal offices at No. 259 Washington street, Jersey City, to manufacture telephones, etc. Capital, $100,000. Incorporators: Clayton B. Clark, Edgar L. Ryder, John McNally, Edmund F. Sheehan, John Gibney, all of Jersey City.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, O., in its Bulletin No. 0134, just issued, describes and illustrates its marine type generators. Views of a 150-kw generator complete, armature coils and yoke are shown, besides dimension diagram and sheet, and an efficiency curve.

THE ELECTRIC APPLIANCE COMPANY, Chicago, reports a large increase in the sales of its Newgard waterproof receptacle and globe. These receptacles are now made in three styls, and are furnished in either Edison or T. H. base. The Electric Appliance Company has just issued a handsome circular describing and illustrating the different styles manufactured.
work.

THE MORGAN ENGINEERING COMPANY, Akron, Ohio, has just received two large contracts for electric traveling cranes, one from Russia, the other from Denmark. This immense plant is being operated to its fullest capacity day and night, giving steady employment to a small army of skilled workmen.

ELECTRICAL NOVELTIES.—The Western Electric Company, Chicago, is distributing to the trade a pamphlet on electric novelties. These consist of emergency search or flash lights; electric walking canes; electric gas lighters; bicycle lamps; dental lamps; electric candles; night lamps, etc., all of the "Ever Ready" brand.

THE FORT WAYNE ELECTRIC WORKS, Incorporated, Fort Wayne, Ind., has issued Bulletin No. 1002 in which are described and illustrated "Wood" constant current dynamos for arc lighting, with improved regulator. An excellent view of a 150-light machine is given together with one showing the regulating mechanism.

THE CENTRAL ELECTRIC COMPANY, Chicago, likes consistency and lately has made a special form of type for advertising purposes of the same outline as upon its stationery. This house states, that while its lines of supplies are many in quantity and design, yet the firm name, for advertising purposes, will not change except in size to meet varying "ad." measurements.

MESSRS. J. B. COLT & CO., 3 West Twenty-ninth Street, New York, have just issued a very complete catalogue of their acetylene gas apparatus and accessories. It contains much information on the subject of acetylene gas, its manufacture and uses. The catalogue contains many illustrations of the apparatus and houses, hotels, etc., equipped with "Criterion" gas plants.

MR. E. V. BAILLARD, 106 Liberty Street, New York, has considerably enlarged his plant to acommodate increased business, and is consequently now in a position to handle more work, in larger quantities and more expeditiously. A specialty will continue to be made of developing inventions to the commercial stage, of model making and special work in the mechanical and physical lines.

BORDEN & SILLECK COMPANY.—Catalogue No. 5 of the Borden & Silleck Company, Chicago, Ill., contains many illustrations and brief descriptions of its improved conveying and elevating machinery. The Harrison conveyor is used in many large electric street railway and other plants in handling coal and ashes. Among these may be mentioned the West Chicago Electric Transit Company, the Toronto Street Railway Company, Toronto, Ont.; the Chicago Public Library Building, etc. The catalogue has 136 pages and covers the subject very completely.

THE STURTEVANT ENGINE is the subject of an artistic catalogue just brought out by the B. F. Sturtevant Company, Boston, Mass. It describes and illustrates Sturtevant engines of all types for electric light plants and general high grade work. The chief advantage claimed for these engines are: Sustained operation at high speed; the utmost refinement in the matter of speed regulation, and the development of maximum horse-power with the minimum of weight and floor space. The catalogue includes illustrations of upright and horizontal engines direct connected to generators.

THE TELEPHONE DEPARTMENT of the Western Electrical Supply Company, St. Louis, Mo., have issued a very attractive pamphlet, covering some of their latest things in the telephone line, entitled, "A Few Ringers." They illustrate a most attractive and thoroughly up-to-date line of series, bridging and extension bells, also a transmitter that is entirely new, is thoroughly moisture and damp-proof, the transmitter proper being hermetically sealed, so that even immersing it in water will not affect it. To any one interested in this line of goods it will prove a very valuable little book. A copy will be mailed upon application.

BARGAINS IN ELECTRICAL APPARATUS.—Messrs. Thompson, Son & Co., 107 Liberty Street, New York, have issued a booklet containing a long list of bargains in electrical apparatus. The list includes motors of all makes and sizes, railway generators, arc dynamos, transformers, arc lamps, ammeters, voltmeters, lightning arresters, alternators, engines, etc., etc. The aim of this firm is to supply the electrical trade with engines and electrical apparatus, and parts and pieces on short notice. The firm quotes only on such machinery that is in prime operative condition. Every one in search of bargains would profit by sending for a copy of this pamphlet.

U. S. TELEPHONE MANUFACTURING COMPANY, 815-17 Market Street, St. Louis, Mo., with reference to recent items about their business inform us that they are absolutely independent of any company whatever, and that while they do interior telephone work it is only a natural and necessary branch of their business, and by no means a specialty. Nor do they limit their work to small exchanges. Within the past fortnight, they have taken a contract for a plant at Houston, Texas, "in the face of nearly all the competition that the independent field could muster." This plant is to have a maximum capacity of 3500 telephones, and it is the intention to install almost the entire capacity before the end of this year. Mr. F. A. Churchill, Jr., is the president of the concern.

MESSRS. W. H. GEORGE & COMPANY, contracting engineers, 120 Liberty Street, New York City, have been awarded the contract for the steam plant, consisting of four 78-inch diam., 20 feet long horizontal return boilers and fixtures, self-supporting steel chimney, 72 inches diam., 110 feet high, for the Standard Ice Manufacturing Company, Pittsburg, Pa.; also for the same plant, four freezing tanks 50 feet long, 27 feet 4 inches wide, 4 feet deep, made of ¼-inch plate, two condenser pans 28 feet by 24 feet by 18 inches deep; two cooler pans, 19 feet by 5 feet by 12 inches deep; two storage tanks 8 feet diam., 10 feet deep, and two galvanized tanks, 4 feet diam., 4 feet 6 inches deep. Messrs. George & Company report a very brisk business and are installing a large number of steam plants throughout the country, their specialty being the design and erection of self-supporting steel chimneys and special tanks.

Record of Electrical Patents.

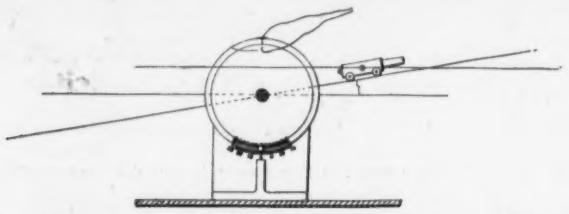
UNITED STATES PATENTS, ISSUED AUG. 1, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

629,792. ELECTRICAL SIGNAL SYSTEM, V. T. Kissinger and A. Trunkel, Chicago, Ill. App. filed June 5, 1899. When any call box of the system is grounded, two separate circuits are thereupon established between the box and a generator at the central station, one for the operation of a motor to drive the signal apparatus and the other for the transmission of the signal. This grounding of the box is accomplished manually.

629,803. DEVICE FOR LIGHTING OR EXTINGUISHING GAS JETS; Oscar von Morstein, of Schoenberg, Germany. App. filed Feb. 17, 1896. The invention consists in the combining of an induction coil and a gas stopcock to be actuated by a primary battery current, so that by closing the circuit at the key, the stop cock will cause the gas to be turned on to a series of gas jets and at the same time and by the same current the induction coil will be operated to cause the ignition of all of the jets simultaneously.

629,819. APPARATUS FOR AUTOMATICALLY DISCHARGING GUNS OF WARSHIPS; J. A. Rowe, London, England. App. filed March 28, 1899. According to this invention the guns are fired by means of an electric



629,819.—Apparatus for Automatically Discharging Guns of Warships.

current passing into a circuit which is normally open, but which is closed by the operation of the apparatus when the ship is upright, or, if desired, when the ship has reached a predetermined angle in its rolling movement.

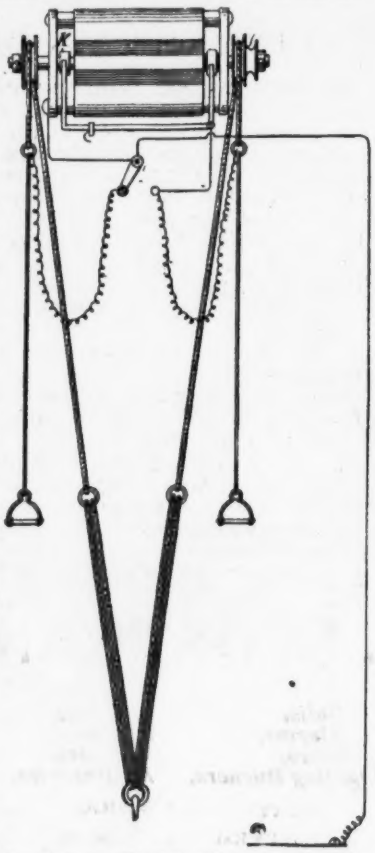
629,823. BRUSH HOLDERS; S. H. Short, Cleveland, Ohio. App. filed Aug. 26, 1898. A supporting bar is arranged in a plane transversely intersecting the commutator and a series of individual brush holders is mounted thereon, the brushes being readily arranged with respect to the axis of the commutator and the bar being adjustable longitudinally on the commutator. The brush holder is adapted for railway motors.

629,837. MOTOR CONTROL; A. H. Whiting, New York, N. Y. App. filed Sept. 27, 1898. (See Current News and Notes.)

629,870. ELECTRIC METER; G. C. Pillinger, London, England. App. filed April 10, 1899. The invention consists in separating the record of current supply in a meter into two parts by means of two recording trains brought into gear alternately by an electromagnet in such a manner that when the rate of supply of current is below a certain limit all current is recorded on one train and when that limit is exceeded all current is recorded on the other train.

629,872. ELECTRIC MOTOR; J. T. Robson, London, England. App. filed Nov. 10, 1898. (See Current News and Notes.)

629,897. ARRANGEMENT FOR STARTING ALTERNATING CURRENT MOTORS; G. Ferraris and R. Arno, Turin, Italy. App. field July 6, 1895. (See Current News and Notes.)



629,909.—Electric Muscular Exercising Apparatus.

629,898. SYSTEM OF ELECTRICAL DISTRIBUTION; G. Ferraris and R. Arno, Turin, Italy. App. filed Oct. 26, 1895. (See Current News and Notes.)

629,909. ELECTRIC MUSCULAR EXERCISING APPARATUS; A. D. McMillan, New York. App. filed June 14, 1899. The exercising apparatus, which is a cord having a weight attached to it and passing over a pulley, is arranged so that the pulley will drive a small generator which will supply current to a circuit leading through the cord and the muscles of the body that are in action.

629,926. RAIL JOINT; J. G. Schrender, Edgewood Park, Philadelphia, Pa. App. filed May 10, 1899. Blocks of insulating material are arranged on opposite sides of the rails and angle bars are constructed to bear against the blocks and support the ends of the rails.

629,936. ELECTRIC CRANE; J. F. Tracy, Pittsburg, Pa. App. filed April 22, 1899. Specific construction of the device for taking the current from the wires extending across the crane to the motor, the object in view being to render it possible to remove and replace one or more of the contacts carried by the truck without disturbing the others.

629,952. MEANS FOR DRIVING MACHINES AT VARIABLE SPEEDS BY ELECTRIC MOTORS; W. A. Chatworthy, Newcastle-on-Tyne, England. The machinery involves a main motor coupled direct to a shaft of the driven machine, an auxiliary small high speed motor geared to the shaft of the main motor and adapted when running at full power, to drive the driven machine at a moderate speed; a self-releasing clutch is arranged between the auxiliary motor and main driving shaft, and devices are used to cut out the motor as soon as the main motor overruns it.

629,957. TELEPHONE EXCHANGE SYSTEM; G. L. Cragg, Chicago, Ill. App. filed May 16, 1898. (See Current News and Notes.)

629,979. ELECTRIC ARC LAMP; F. Booker, London, England. App. filed Feb. 28, 1899. The invention consists of the specific construction of a friction clutch.

630,071. DEPOLARIZATION SUBSTANCE FOR ELECTRIC BATTERIES; G. Platner, Witzenhausen, Germany. App. filed Dec. 28, 1897. (See Current News and Notes.)

630,076. ELECTRIC SWITCH; J. E. Sayles and H. E. Reeve, Montclair, N. J., and New York, N. Y., respectively. App. filed March 26, 1898. For the purpose of lightness, ventilation and low cost, the switch comprises a sheet metal base having stiffening flanges and retaining lugs struck up therefrom, an insulating block secured to the base and centered between the lugs, a block having contacts thereon, and a lever pivoted upon the base.

630,113. ELECTRICALLY OPERATED DISPLAY TURNTABLE; W. Rolle, Philadelphia, Pa. App. filed Oct. 18, 1898. A turntable for the display of wares, the invention consisting of an electric motor having a commutator and two sets of brushes applicable to contact with the commutator to obtain reversed motion; means are provided for changing the contacts of the brushes. The table will turn continuously in either direction or make a partial rotation in either direction and then reverse.

630,151. AUTOMATIC TELEGRAPHY; S. Spitehall, South Bend, Ind. App. filed Feb. 4, 1898. The method consists in making up a message of parallel lines telegraphically, transmitting the lines and recording them in the form of one continuous line, and then reproducing the message by dividing the line and arranging the divisions side by side to form a fac-simile of the original message.

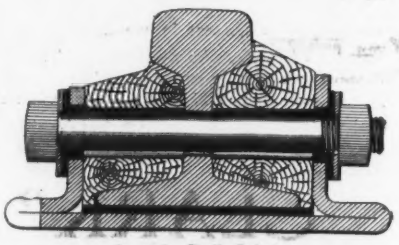
630,152. AUTOMATIC TELEGRAPHY; S. Whitehall, South Bend, Ind. App. filed Feb. 1, 1899. An improvement on the preceding wherein one of the objects is to construct a receiver in which the lines produced thereon can be adjusted and brought into proper relation to each other should the receiving instrument move faster or slower than the transmitter.

630,153. TROLLEY RAIL FOR ELECTRIC ROADS; W. A. P. Willard, Jr., Hull, Mass. App. filed Dec. 24, 1898. Details of construction relating to the mounting and support of the third rail.

630,178. ELECTRIC CLOCK; R. Bürk, Schroenning, Germany. App. filed Nov. 6, 1897. The invention consists in so constructing the pawl and ratchet mechanism which transmits the motion of the pendulum to the clock train, that when the oscillations of the pendulum reach their minimum the pawl itself serves to close a circuit to give an impulse to the pendulum.

630,203. COMBINED LETTER BOX AND BELL; H. Elrod, Ladoga, Ind. App. filed Dec. 19, 1898. The invention refers to the details of construction of a letter box, wherein the deposit of a letter will be announced by an electric bell.

630,210. TROLLEY WHEEL; H. R. Frisbie, Belleville, N. J. App. filed June 30, 1897. To make a cheap and self-lubricating wheel, it is constructed in three parts, the centre or conductor proper being of copper, while the sides are of a cheaper grade of metal, a chamber being formed by the joinder of the three parts wherein graphite or other lubricant is placed and allowed to pass to the axle through suitable perforations.



629,926.—Rail Joint.

630,233. REGULATING ALTERNATING CURRENT DYNAMO ELECTRIC MACHINES; M. Hutin and M. Leblanc, Paris, France. App. filed April 10, 1897. (See Current News and Notes.)

630,280. SYSTEM OF ELECTRICAL DISTRIBUTION; G. T. Woods, New York, N. Y. App. filed Oct. 30, 1896. (See Current News and Notes.)

630,292. ELECTRIC SWITCH AND ALARM; G. W. McKenzie, Beaver, Pa. App. filed July 16, 1898. A weight, which normally holds an alarm circuit open, is supported upon a fusible block; when the block melts the weight falls and closes the circuit.

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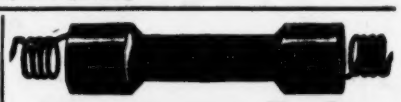

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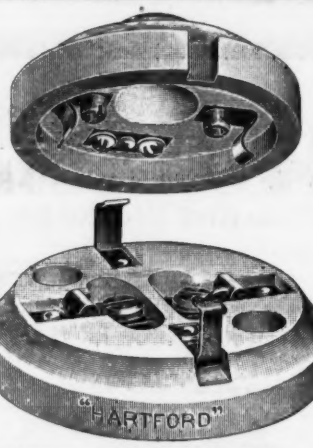

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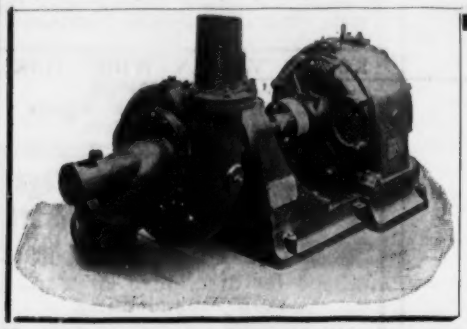

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(Continued on page 52.)

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1	2	" Card self-oiler	2,500
1	2	" Jenney self oiler.	
1	2	" E. & C. new M. P. self-oiler	1,800
1	3	" Jenney self-oiler.	
1	3	" E. & C. new M. P. self-oiler.	
1	4	" Wenstrom iron-clad slow speed	525
1	4	" Kester M. P. self-oiler	1,200
1	5	" Detroit self-oiler.	
1	5	" Ft. Wayne Jenney.	
1	5	" T.-H. type I. B. self-oiler	1,700
1	5	" E. & C. M. P. new self-oiler	1,800
1	7½	" Detroit self-oiler	1,300
1	7½	" Edison 6-k. w.	1 350
1	7½	" Detroit El. Wks. self-oiler.	
1	7½	" Westinghouse s. o. rewound M. P.	1,350
1	10	" Mather ring type.	
1	10	" Eddy s. o. ring type	1,200
1	10	" Jenney self-oiler.	
1	10	" Edison 8¼-k. w. self-oiler	1,325
1	12	" Detroit El. Wks. self-oiler.	
1	13½	" Western Electric.	
1	15	" Westinghouse letter type s. o.	1,300
	15	" Edison 12-k. w. self-oilers	1,275
1	18	" T.-H. type D15	1,400
1	18	" Triumph self-oiler.	
1	20	" Westinghouse M. P. self-oiler	1,050
1	20	" General El. M. P. slow-speed s. o.	600
1	24	" Eddy self-oiler.	
1	25	" Jenney s. o. new armature.	
1	25	" National brand new s. o.	
1	25	" Edison 20-k. w. self-oiler	1,100
1	30	" Triumph self-oiler.	
2	30	" Edison 25-k. w. self-oiler	950
1	35	" Kester self-oiler	1,000
1	45	" National self-oiler	1,000
1	50	" Mather self-oiler M. P.	
1	60	" Rockford 60-k. w. s. o.	
1	60	" National brand new 45-k. w.	800
1	60	" Edison 45-k. w. self-oiler	750
1	75	" Jenney self-oiler.	
1	75	" National 60-k. w., new	800

220-VOLT MOTORS.
ACTUALLY IN STOCK.

			Speed.
1	¼-h-p	Diehl series wound.	
1	¼	" Heltzer-Cabot	1,850
1	1	" Sprague oil cup	1,600
2	1	" Sprague self-oilers	1,800
2	1	" Eddy self-oilers	2,400
1	1	" C & C self-oiler, new armature.	
2	1	" Edison 3-4-k. w. self-oilers	1,850
1	1	" Crocker-Wheeler self-oiler	1,150
1	1	" Ahlin Edwards new slow speed.	1,300
1	2	" Eddy self-oiler	1,750
1	2	" Lundell slow speed s. o.	980
1	2	" E. & C. brand new M. P. s. o.	2,000
1	3	" C & C oil cup	1,650
1	3	" Connecticut self-oiler.	
1	3	" Eddy self-oiler	1,700
1	3	" E & C new M. P. s. o.	
2	3	" Card Manchester type s. o.	1,000
1	3	" G. E., slow speed type I. B.	940
1	4	" Eddy self-oiler	1,600
1	5	" Detroit four-field type	1,200
1	5	" Akron self-oiler	1,800
1	5	" Akron slow speed s. o.	1,000
1	5	" Eddy self-oiler	1,850
1	5	" Eddy slow speed s. o.	1,300
1	5	" E. & C. self-oiler M. P. new	1,800
1	7½	" Ft. Wayne Jenney.	
1	7½	" Eddy self-oiler	1,800
1	7½	" Eddy slow speed s. o.	1,450
1	7½	" Sprague self-oiler	1,300
1	7½	" Edison self-oiler	1,350
1	7½	" E. & C. self-oiler M. P., new.	
1	7½	" Westinghouse M. P. new rewound	1,350
1	10	" Detroit, with extra armature	1,400
1	10	" Sprague self-oiler	1,200
1	10	" Eddy self-oiler	1,625
1	10	" Edison 8¼-k. w. self-oiler	1,325
1	10	" Fisher M. P. self-oiler.	
1	15	" Eddy type C self-oiler	1,850
1	15	" Edison 12-k. w. self-oiler	1,275
1	18	" Edison 15-k. w. self-oiler	1,150
2	25	" Edison 20-k. w. self-oilers	1,100
2	50	" Edison 25-k. w. self-oilers	950
1	55	" Crocker-Wheeler M. P. s. o.	700
1	50	" Westinghouse self-oiler	550
2	60	" Edison 45-k. w. self-oilers	850
1	125	" Edison 100-k. w. new armature.	550

500-VOLT MOTORS.
ACTUALLY IN STOCK.

			Speed.
1	1-h-p	E. & C. new M. P. self-oiler.	
1	2	" E. & C. new M. P. self-oiler	2,000
1	3	" Sprague oil cup.	
1	3	" Jenney self-oiler	2,700
1	3	" Jenney series wound	2,150
1	3	" Detroit self-oiler.	
1	3	" E. & C. new M. P. self-oiler.	
1	5	" D. & D. oil cup	1,460
1	5	" Wood self-oiler	1,400
1	5	" E. & C. Multipolar s. o.	1,800
1	7½	" Commercial s. o., new	1,840
1	7½	" E. & C. multipolar s. o.	1,030
1	10	" Eddy self-oiler.	
1	10	" Card self-oiler	1,175
1	10	" Crocker-Wheeler slow speed	850
1	12	" T.-H. 10-k. w. oil cup	1,600
1	12	" T.-H. 10-k. w. self oiler	1,600
1	12	" C & C iron-clad M. P., new	850
1	15	" Card self-oiler	1,400
1	15	" Crocker-Wheeler s. o., slow speed.	
1	15	" Gibbs M. P., self-oiler.	
1	18	" Edison self-oiler	1,300
1	20	" Card self-oiler	1,350
1	22	" E. & C. new M. P. self-oiler	800
1	30	" Edison 25-k. w. s. o.	1,025
1	30	" Rockford new self-oiler	1,320
1	35	" Jenney self-oiler	1,150
3	60	" Edison 45-k. w. self-oilers	850
1	125	" Edison 100-k. w. No. 32	550
1	135	" Commercial M. P.	

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1	½	" Stanley 16,000 alt., 100-volt	2,258
1	1-h-p	Ft. Wayne 125-cycle 100-volt	2,500
2	1	" Westinghouse 16,000 alt., 100-volt	2,000
1	2½	" Ft. Wayne 16,000 alt., 100-volt	2,800
1	5	" Ft. Wayne 125-cycle, 100-volt	1,875

MULTIPHASE.

			Speed.
1	2-h-p	Stanley two-phase, 16,000 alt., with condenser, 500-volt transformer for same, 1,000 or 2,000 volts to 500.	
1	2	" Gen. Elec. type T. I., 3-phase, 60-cycle, 110 volts	1,800
4	3	" Westinghouse (Tesla) 2-phase brushless type, 7,200 alt., any voltage	1,800
1	40	" Gen. Elec. type I 8-10-900, 110 volts, 60 cycles	900
2		Type G. transformers for same, 1,040 or 520 to 115 or 230.	
1	20	" Gen. Elec. 3-phase type I monocyclic, 60-cycle, 220 volts, class 8-20-900	900
2		10-k. w. Transformers for above, 520 or 1,040 volts to 220.	
1		30-h-p Gen. Elec. 3-phase type I, form A, monocyclic, 60-cycle, 220 volts, class 8-30-900	900
2		15-k. w. Transformers for above, form A, 520 or 1,040 volts to 220.	

MOTOR GENERATORS.

1	¼-h-p	Crocker-Wheeler 115 to 300	1,800
1		3-k. w. Edison, 500 to 60 volts.

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2, M.P. 4-100-650 General Electric.
2, 100 Kw. Edison bi-polar.
2, D- 62 bi-polar T.-H.

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2, 750 light Westinghouse, 1000 volts, 16,000 alternations, smoothed body armature; very cheap.
2, 60 Kw. General Electric, 2000 volts, toothed armature, with exciters and instruments.
2, 30 Kw. Westinghouse, 1000 volts, 16,000 alternations, toothed armature, with exciters.
2, 300 Kw. Westinghouse, single phase type, ironclad, toothed armature, 1000 volts.
2, A 120 Kw. General Electric, 1000 volts, 16,000 alternations, toothed armature, with exciters and instruments.
2, 180 Kw. Stanley two-phase, 2000 or 1000 volts, latest type, practically new.
2, 150 Kw. Stanley, two-phase, 2000 or 1000 volts, latest type.
2, 200 Kw., same as above.
2, 240 Kw., same as above.
2, 120 Kw., same as above.
2, 180 Kw. General Electric, single phase, latest type, ironclad, toothed armature, 2000 or 1000 volts, 16,000 alternations.

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45 Kw. Edison bi-polar.
30 Kw. Edison bi-polar.
25 Kw. Edison bi-polar.
20 Kw. Edison bi-polar.
15 Kw. Edison bi-polar.
10 Kw. Edison bi-polar.
7½ h.p. Eddy.

(110 Volts.)

2, 12 Kw. Edison, bi-polar, compound wound.
1, 37 Kw. Westinghouse, compound wound.
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1, 300-light horizontal type Westinghouse.
2, M.P., 6-175-150, 125 volts, 175 Kw., General Electric, for direct connection.
2, 75 Kw. M.P. Westinghouse, modern speed.
2, 75 Kw. Standard, M.P., modern speed, General Electric.

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80 Kw. Siemens Halske M.P.
25 h.p. C & C.
15 h.p. General Electric M.P.
2, 4½ Kw. General Electric M.P.
1, 10 h.p. Westinghouse M.P.
2, 10 h.p. Eddy M.P.
1, 5 h.p. Eddy.
Besides other machines as small as ½ h.p.

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2, 45-light 1000 C.P. Brush.
2, 30-light 1000 C.P. Brush.
2, 120-light 2000 C.P. Brush, latest type.
2, 125-light 1200 C.P. Brush, latest type.
2, 45-light C.P. T.-H.
2, 30-light 2000 C.P. T.-H.
2, 30-light C.P. Brush.
2, 25-light 2000 C.P .T.-H.
2, No. 8 65-light 2000 C.P. Brush.

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1, 15 h.p. Keystone, slow speed, 600 r.p.m.
1, 15 h.p. General Electric multipolar, moderate speed.
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			Speed.
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1	50 "	E. & C. new multipolar s. o...	1,850
1	60 "	Wenstrom comp. iron-clad.....	825
1	65 "	Kester multipolar s. o	1,280
1	70 "	Ft. Wayne Jenney oil cups.	
1	75 "	E. & C. multipolar new s. o..	2,000
1	75 "	G. E. type I. B. s. o., ...	1,800
1	80 "	Detroit self-oiler.	
1	100 "	Detroit self-oiler	1,300
1	100 "	Westinghouse self-oiler, M. P. newly rewound	1,350
1	110 "	Edison 6-k. w. oil cup, newly rewound	1,800
1	120 "	Detroit El. Wks. self-oiler	1,800
1	150 "	Eddy self-oiler, ring type.	
1	150 "	Mather, ring type	1,650
1	150 "	Edison 8½-k. w. comp. s. o. ...	1,700
1	160 "	Jenney comp. self-oiler.	
1	180 "	Detroit Electrical Works, s. o.	
1	180 "	Westinghouse letter type s. o..	1,400
1	200 "	Western Elec., oil cups..	1,850
2	210 "	Edison 12-k. w. self-oiler	1,400
1	210 "	Edison 12-k. w. s. o. comp. ...	1,400
1	250 "	Thomson-Houston type E. I. compound	1,250
1	270 "	Thomson-Houston D15 comp..	1,400
1	270 "	Triumph multipolar s. o.....	1,060
1	270 "	Westinghouse self-oiler, comp. M. P.	1,050
1	300 "	G. E. multipolar s. o	700
1	325 "	Eddy self-oiler.	
1	350 "	National 20-k. w. brand new s. o..	
1	350 "	Jenney self-oiler, comp., new armature.	
1	350 "	Edison 20-k. w. self-oiler comp	1,400
1	450 "	Triumph, 25-k. w., comp, s. o.	950
4	450 "	Edison 25-k. w. s. o.,	1,300
2	480 "	Brush, comp. closed coil type.	1,150
1	500 "	Kester self-oiler compound.....	1,000
1	540 "	National comp. self-oiler	1,150
1	800 "	Rockford 50-k. w. s. o. new armature.	
1	800 "	Mather 50-k. w. s. o. comp.	
1	800 "	Edison 45-k. w. self-oiler comp.	1,000
1	820 "	National 45-k. w. brand new s. o. comp	875
1	1000 "	Jenney s. o. compound	825
1	1000 "	Nat. 60-k. w. brand new s. o. compound	900
1	1350 "	Waddell-Enz. 80-k. w. for direct connection	265

220-VOLT GENERATORS.

ACTUALLY IN STOCK.

			Speed.
1	6-k. w.	Ft. Wayne Jenney oil cup.	
1	7 "	E. & C. new self-oiler M. P. shunt.	
1	8½ "	Eddy self-oiler.	
1	8½ "	Edison self-oiler	1,700
1	8½ "	Fisher multipolar s. o.	
2	12 "	Eddy self-oilers.	
1	12 "	Edison shunt self-oiler	1,600
1	12 "	Edison self-oiler	1,600
1	15 "	Edison self-oiler	1,500
2	20 "	Edison self-oilers, ...	1,400
2	25 "	Edison self-oilers, ...	1,300
1	30 "	Crocker-Wheeler M. P. s. o....	750
1	40 "	Westinghouse, s. o.....	550
2	45 "	Edison s. o. comp., newly rewound	1,000
1	100 "	Edison No. 32 s. o. comp., new armature	650

500-VOLT GENERATORS.

ACTUALLY IN STOCK.

1	15-k. w.	Edison self-oiler	1,500
1	17 "	Card self-oiler	1,350
1	18 "	E. & C. new s. o., M. P.	950
1	25 "	Rockford s. o. comp. Manchester type	1,425
1	25 "	Edison self-oiler	1,300
1	30 "	Jenney self-oiler,	
1	45 "	Edison self-oiler compound.....	1,000
3	45 "	Edison s. o. comp., newly rewound	1,000
1	100 "	Edison No. 32 s. o. compound, new armature	650
1	100 "	Commercial s. o. comp. M. P..	700
1	200 "	Triumph 6-pole s. o. new comp.	700

ARC DYNAMOS.

ACTUALLY IN STOCK.

1	20-light,	2000-c.-p.	Excelsior s. o. aut. regulator		1,350
1	20 "	1200 "	Excelsior s. o. hand reg.		
1	20 "	2000 "	West. Elec. aut. reg..		1,650
1	20 "	2000 "	Brush No. 6, dial reg.		1,100
1	25 "	1200 "	Ft. Wayne Wood No. 5, aut. regulator.		1,075
1	25 "	2000 "	T.-H. type L2, ball armature		850
1	25-light,	2000-c.-p.	T.-H. type L2, ring armature, s. o.		850
1	30 "	2000 "	Western Electric		1,400
2	30 "	2000 "	Brush No. 7 dial reg..		1,050
1	35 "	2000 "	T.-H. type L D2 ball armature		820
1	35 "	2000 "	T.-H. type L D2, new ball armature.....		820
2	35 "	2000 "	T.-H. type L D2 ring armature		820
3	40 "	2000 "	Wood No. 7		925
1	40 "	2000 "	West. Elec. self-oiler.		1,300
1	45 "	1200 "	T.-H. type M12 ball armature		850
1	45 "	1200 "	T.-H. type M12 new ball armature		850
3	45 "	1200 "	Brush No. 7 dial regs.		1,050
1	50 "	1200 "	Standard		950
1	50 "	2000 "	Standard s. o. new armature and com..		950
1	50 "	1200 "	T.-H. type L D12 s. o. ball armature...		820
1	50 "	1200 "	T.-H. type L D12 s. o., new ball arm't.		820
1	50 "	1200 "	T.-H. type L D12, s. o., new ring arm't..		820
1	50 "	2000 "	T.-H. type M D, new ball armature		820
1	50 "	2000 "	T.-H. type M D, new ring armature		820
1	50 "	2000 "	Excelsior new latest type aut. reg.....		900
2	60 "	2000 "	Ft. Wayne Wood No. 8.		900
1	60 "	2000 "	Ft. Wayne Wood No. 8, newly rewound...		900
4	65 "	2000 "	Brush No. 8 dial reg.		950
3	75 "	1200 "	Wood Ft. W. No. 8..		900
1	100 "	2000 "	Western El. latest type M. P. s. o.....		530
5	125 "	1200 "	Excelsior latest type s. o.		700
1	125 "	2000 "	Ft. Wayne Wood No. 10, newly rewound..		560

ALTERNATING GENERATORS.

ACTUALLY IN STOCK.

			Speed.
1	500-light	Bain 30-k. w. 1100 or 2200 volts self-oiler, new armature, with exciter and instruments, 15,000 alternations	1,500
1	600-light	Thomson-Houston 30-k. w., 1000 volts, two-phase, 15,000 alternations with exciter and instruments	1,500
1	600 "	National 30-k. w. exciter on same shaft, 1100 volts, 16,000 alternations, surface wound armature with instruments.....	1,600
1	650 "	Standard inductor type, 35-k. w. self-oiler, 1100 volts, 15,000 alternations, with exciter and instruments	1,300
3	650 "	Thomson-Houston A 35, 1100 volts, 15,000 alternations, composite wound with exciters and instruments.....	1,500
3	650 "	Thomson-Houston A 35, 1100 volts, 15,000 alternations composite wound, self-oilers	1,500
3	750 "	Westinghouse No. 1, 1100 volts, 16,000 alternations, with exciter and instruments	1,650
1	750 "	Westinghouse No. 1, 1100 volts, 16,000 alternations without exciter and instruments.....	1,650
1	750 "	Westinghouse No. 1, 2200 volts, 16,000 alternations, new armature, with or without instruments	1,650
1	750 "	National 35½-k. w. brand new, latest type, 1100 volts, 16,000 alternations, toothed armature, with direct connected exciter and marble switchboard	1,600
1	900 "	Royal 45-k. w., 1100 volts, with exciter.	
1	1000 "	National 1100 volts, 15,000 alternations, new armature, with exciter and instruments.....	1,500
1	1000 "	Ft. Wayne Wood, 50-k. w., 1100 volts, 16,800 alt., self-oiler toothed armature, comp. wnd., exciter and instruments.	
1	1200 "	Westinghouse 60-k. w. comp. toothed armature, 1100 volts, 16,000 alt., with exciter and instruments	1,650
1	1300 "	Westinghouse 70-k. w. 1100 volts, 16,000 alt., smooth body armature, with exciter and instruments	1,650
1	2400 "	Westinghouse 120-k. w., 1100 volts, latest type, 16,000 alternations, toothed armature s. o., composite wound.	

NOTICE.—All machines are actually in stock ready for prompt delivery. All machines are guaranteed. Write for particulars and send for MONTHLY BARGAIN SHEET, with net cash prices.

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Write us for Price Lists Nos. 25 and 26.

DIRECT CURRENT DYNAMOS, ALTERNATING CURRENT DYNAMOS, ARC DYNAMOS, ENGINES, BOILERS, HEATERS, PUMPS.
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10,000 Key and Keyless; brand new, 8c. each.
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One tandem compound 12x16x18; excellent condition, $850.00.
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600 LIGHT NATIONAL ALTERNATOR.
FOR SALE.
1000 volt, with exciter.....$275.00
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T.-H. ARC LAMPS.
FOR SALE.
100 Single K-2, $5.00 | 65 Double, M-2, $10.00
67 Single, K-12, 7.00 | 2 Double, M-12, $10.00
ROSE ELECTRIC CO., St. Louis, Mo.

BARGAINS FOR SALE, NEW AND GOOD SECOND-HAND.

100 K. W. 500-Volt Edison Dynamos
1 37½ K. W. 125-Volt Belted Westinghouse; 300 Rev.; New.
2 D 50 125-Volt T. H.
1 35-H.P. 220-Volt Sprague Motor.
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ENGINES.
2 McIntosh & Seymour, 18½x18.
1 Erie Ball, 18x16.
2 18x42 Allis Corliss.
2 12x12 Armington & Sims.
2 13x12 Automatic Armington & Sims.
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TRANSFORMERS.

90—10	Light	Stanley	1,000	to	50	$6.00 each
20—10	"	"	"	"	100	6.00 "
20—15	"	"	"	"	50	8.00 "
40—20	"	"	"	"	50/100	10.00 "
25—30	"	"	"	"	50/100	15.00 "
21—40	"	"	"	"	50/100	20.00 "
21—50	"	"	"	"	50/100	25.00 "
2—75	"	"	"	"	50/100	38.00 "
2—100	"	"	"	"	50/100	52.50 "

The above are ready for immediate delivery and are strictly first class. Also a quantity of Railway Motors, Cars, Trucks and Controllers, Arc and Incandescent Dynamos and Motors.

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PROPOSALS WANTED

For Steam and Electric Machinery for Municipal Electric Lighting Plant, City of Monroe, Michigan.—Sealed Proposals will be received at the office of the City Clerk of the City of Monroe, Michigan, until 8 o'clock, p. m., on the 12th day of August, 1899 (at which time such proposals will be opened), for the furnishing of all labor and materials for the construction of the necessary Building, Engines, Dynamos, Lamps, Pole Line, etc., for an Electric Lighting Plant for said city, in accordance with the plans and specifications on file with the City Clerk.

All bids must be addressed, "City Clerk, Monroe, Michigan," and endorsed on outside of the envelope, "Bids for Electric Lighting Plant," and the divisions of the specifications for which the proposal is made.

Each bidder must deposit with his bid a certified check for an amount equal to 5 per cent. of the total amount of his proposal, payable to the order of the Treasurer of the City of Monroe, Michigan, which sum shall be forfeited to said city in case the bidder refuses or neglects to enter into a contract with said city, pursuant to the terms of his bid and the plans and specifications on file (subject to confirmation by the City Council), within five days after he shall have been notified of the acceptance of his bid or proposal. Checks deposited with rejected bids will be returned to owner on demand.

The bidder whose bid is accepted will be required to furnish with his contract a good and sufficient bond to be approved by the Mayor and Council of the City of Monroe, Michigan, in such sum, not exceeding the amount of his contract, as the Mayor and Council shall determine, conditioned on the full and faithful performance on his part of the contract. Another bond, running to the People of the State of Michigan, will be required, conditioned for the payment of wages earned and material, apparatus and machinery furnished in the performance of the contract. On the proper execution of the contract and bonds the guarantee deposit will be returned to the contractor.

Copies of the specifications can be seen at the office of the City Clerk, or at the office of the City's Engineer, A. S. Van De Mark, Room 12, 82 Griswold St., Detroit, Michigan. All proposals must be made out on blanks provided for that purpose. The Council expressly reserves the right to reject any or all proposals and to waive irregularity in any proposal.

JOHN STEINER,
City Clerk.

Dated at Monroe, Michigan, this twenty-fifth (25th) day of July, 1899.

For Sale.—Bargains.

Two L. D., 2,000-C.P., T.-H. Dynamos.
Two L., 2-000-C.P., T.-H. Dynamos.
Newly rewound and good as new; self oiling.
Forty Type K, 2,000-C.P., T.-H. Arc Lamps.
One 20-K.W., 110-V. Edison Dynamo.
One 400-Light Brush Incandescent Dynamo.
One 50-Light United States Incandescent Dynamo.
One 12-H.P. Jenney 500-Volt Motor.
One 3-H.P. Detroit 500-Volt Motor.
Type E, T.-H. Transformers, Instruments, etc.

These are bargains.

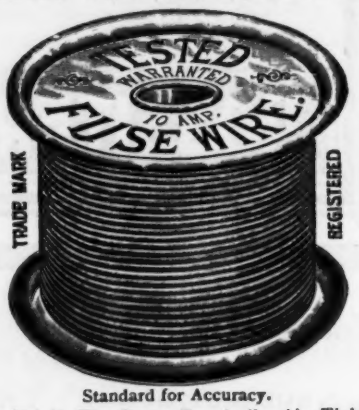
Address "BOX 136," Farmington, Conn.

NOTICE is hereby given that sealed bids for the lighting of the streets of the city of Williamsport, Pennsylvania, by electricity, gas or other light, for all night and every night from dark to daylight for a period of five years from Dec. 1, 1899, will be received until Sept. 1, 1899, at 10 o'clock a. m. Each bid shall state the number of lights proposed to be furnished, the location thereof, the kind of light, candle power and the system to be used, and shall be accompanied by a certified check of $1000 to be forfeited as liquidated damages in case the successful bidder fails to execute contract and furnish the necessary bond. The city reserves the right to reject any or all bids. All bids must be sealed and addressed to

THEO. CORNMAN,
City Clerk.

Williamsport, Pa., July 19, 1899.

TRADE MARK.
TESTED FUSE WIRE AND LINKS.



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Gas Engines for Electric Light from 2 H. P. up to 25 H. P. now ready. Write for prices.
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All kinds of second-hand
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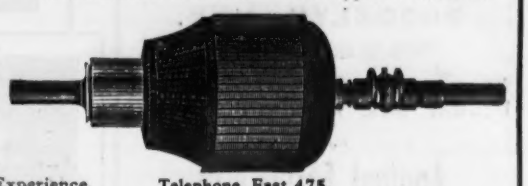

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SEND IT TO US AT ONCE.

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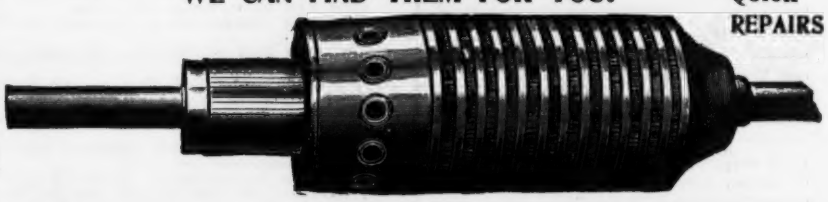

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750 LIGHT ALTERNATOR

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Westinghouse, 16,000 alternations; complete, $300. ROSE ELECTRIC CO., St. Louis, Mo.

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A factory well equipped with power presses, screw machines, lathes, bench lathes, complete tool room, electro-plating and polishing outfit, and 25 H. P. engine, in a good town not far from Chicago, with plenty of desirable help. "B. T.," care Electrical World and Engineer, New York.

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Two Fort Wayne Dynamos, 32½-kw, complete with instruments, 1000 volts.
One 600-light United States Dynamo, 110 volts.
Two 350-light Richter Dynamos (bi-polar), 110 volts.
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One 200-light Richter Dynamo (bi-polar), compound, 110 volts.
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One 100-light Consolidated Dynamo, 110 volts.
One Westinghouse 40-arc-light Alternating Dynamo, 2000-cp, self-exciting.
Two 35-arc-light American-Wood Dynamos, self-regulators, 2000-cp.
One 20-arc-light American-Wood Dynamo, hand regulator.
One 25-hp C & C Motor, 220 volts, A No. 1 condition.
One 10-hp Eddy Motor, 220 volts.
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Large stock of small Motors and Dynamos.
Large stock of Automatic Engines, Ball, Ames, Armington & Sims and Corliss Engines up to 500-hp. Also Boilers.

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POSITIONS WANTED

(Continued from page 48.)

POSITION WANTED—By 1898 graduate as electrical engineer. At present employed in a large manufacturing company; would like to obtain another position. Good reason will be given to interested party for desiring to change. Address "C. N. D.," care Electrical World and Engineer, New York.

POSITION WANTED—A central station manager, who is a practical mechanical and electrical engineer of 12 years' experience in building and operating electric light, power and electrolytic plants, is open for engagement. Have made a study of station economy and business detail, and can make dividends for the stockholders; 35 years of age, and married. Address "C. F. G.," care Electrical World and Engineer, New York.

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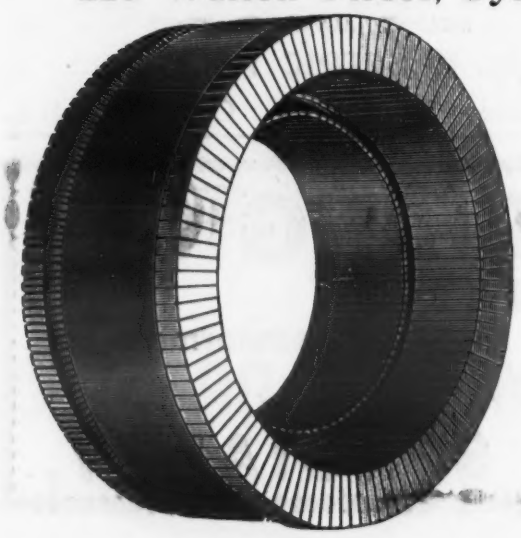

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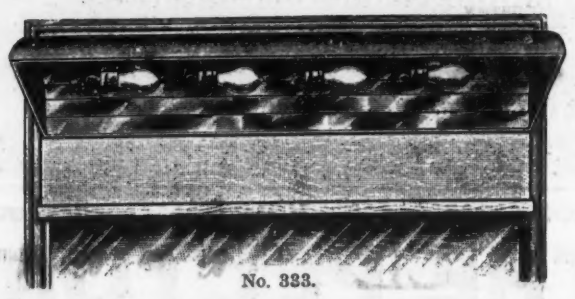

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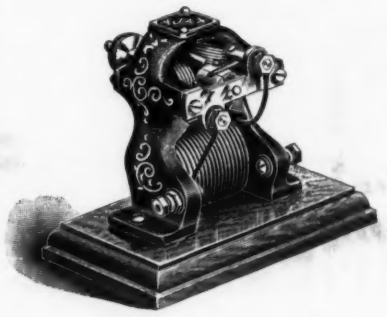

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Abbott Electric & Mfg. Co. ....
Adams-Bagnall Electric Co. 27
Advance Specialty Co. 18
Allington & Curtis Co. 47
American Battery Co. 47
American Bell Telephone Co. 58
American Electric Specialty Co. ....
American Electric Telephone Co. 58
American Electric Vehicle Co. 22
American Electrical Heater Co. ....
American Electrical Works 47
American Fire Engine Co. 66
American Gas Furnace Co. 70
American Hard Rubber Co. ....
American Impulse Wheel Co. 29
American Reflector and Lighting Co. 13
American Vitrified Conduit Co. 2
Anderson Mfg. Co., A. & J. M. 5
Ashcroft Mfg. Co. ....
Audit Co., The ....
Aultman Co., The 64
Austin & Co., M. B. 14

Bacon Air Lift Co. 63
Baillard, E. V. 2
Baker & Co. 3
Ball Engine Co. 69
Barnes Co., The Wallace 55
Barnes Co., W. F. & John. ....
Barnett & Co., G. & H. 72
Becker Bros. 51
Belknap Motor Co. ....
Berlin Iron Bridge Co. ....
Bernard Co., The E. G. 63
Besly & Co., Charles H. 72
Bibber-White Co. 8
Biddle, James G. 4
Bickford Drill & Tool Co. 69
Bliss Co., E. W. 70
Bogart Co., A. L. 3
Bogue, Charles J. 25
Bossert Electric Const. Co. 11
Bowsher Co., N. P. 70
Brady, T. H. 10
Bristol Company 1
Bryan & Humphrey 55
Bryant Electric Co., The 3
Buckeye Electric Co. ....
Bullock Electric Mfg. Co. ....
Bullock Mfg. Co., M. C. 65
Bunnell & Co., J. H. 14
Burns, John 11
Burrows Mfg. Co. 64
Burt Mfg. Co. 1

C & C Electric Co. 63
Cameron, H. P. ....
Carlisle & Finch Co., The 9
Carpenter Die & Tap Co., J. M. 72
Cary Spring Works 21
Cascadilla School 53
Case Mfg. Co. 64
Central Electric Co. 19
Central Mfg. Co. 10
Central Telephone & Electric Co. 57
Chase-Shawmut Co. 17
Chesley Machinery Co. 50
Chicago Belting Co. 72
Chicago Edison Co. 50
Chicago Fuse Wire & Mfg. Co. ....
Chicago General Fixture Co. 11
Chicago Insulated Wire Co. 55
Chicago Rheostat Co. 6
Cincinnati Milling Machine Co. 69
Cleveland Armature Works ....
Cleveland Electric Co. 18
Cohn & Bock 10
Colt & Co., J. B. ....
Columbia Incandescent Lamp Co. 17
Columbian Car L't'g & Brake Co. 25
Colwell Lead Co. 30
Commercial Electric Co. ....
Conn. Telephone & Electric Co. 57
Conover Mfg. Co. 68
Consolidated Safety Valve Co. 68
Cornell Machine Co. 67
Crane Co. 67
Creaghead Engineering Co. 10
Crocker-Wheeler Co. 72
Crosby Steam Gage & Valve Co. 21

Croselmire, C. F. 2
Cutler-Hammer Mfg. Co. 25
Cutter Co., George 10
Cutter Co., The 24
Cutter Electrical & Mfg. Co. 1

Dake Engine Co. 64
Dawson & Co., A. L. 50
Dayton Globe Iron Works Co. 28
Dearborn Drug & Chemical Works. 26
Delaware Hard Fibre Co. 72
Diamond Meter Co. ....
Directory of Engineers 55
Dixon Crucible Co., Jos. 4
Dyer, Edmonds & Dyer 47

Eames Co., G. T. 70
Eastern Electric Cable Co. ....
Eccleston Lumber Co. 10
Edison Mfg. Co. 6
Edwards & Co. 55
Elbridge Electrical Mfg. Co. ....
Electric Appliance Co. 30
Electric Motor & Equipment Co. 7
Electric Storage Battery Co. 3
Electrical Construction Supply Co. ....
Electrical Engineer Inst. of Cor. Inst. 47
Elliott Electric Co., W. H. 51
Elwell-Parker Electric Co., The 61
Emerson Electric Mfg. Co. 30
Empire China Works 47
Empire Electrical Instrument Co. 7
Engineers, Directory of 55
Eyanson & Armpriester 2

Fagan, J. C. 55
Falk Company, The 15
Faries Mfg. Co. 27
Felten & Guilleaume ....
Ferracute Machine Co. 70
Field & Everett ....
Forest City Electric Works 2
Franklin Electric Supply House ....
Frick Co. 64
Frink, I. P. 21
Ft. Wayne Electric Works 6
Fuller Co., The 14
Fuller, John E. 27

Garlock Packing Co. ....
Garton-Daniels Electric Co. 22
Garvin Machine Co. 69
Gates & Randolph 55
General Electric Co. 11
General Equipment Co. 18
General Incandescent Arc Light Co. 13
Goldmark & Wallace 47
Goldsmith Bros. 28
Gold Street Car Heating Co. 30
Gordon Battery Co. 8
Goubert Mfg. Co., The 67
Green Fuel Economizer Co. 65
Gregory Co., Charles E. ....48 and 49

Hadaway Electric Heating & Eng'g Co. ..25
Hammacher, Schlemmer & Co. ....
Hardmuth & Co. 21
Hardy Lamp Company 22
Harrington, Son & Co., Ed. ....
Harrisburg Foundry & Machine Wks. 66
Harris, F. R. ....
Hart & Hegeman Mfg. Co., The 5
Hartford Steam Boiler Inspection & Insurance Co. ....
Hart Mfg. Co. 2
Harvard Electric Co. ....
Harvey Co., The G. F. 47
Hawley Down Draft Furnace Co. 65
Hayden & Derby Mfg. Co., The ....
Hays Construction Co. 63
Heald & Son, L. S. 68
Heine Safety Boiler Co. ....
Herrick, A. B. 55
Hobart Electric Mfg. Co. 72
Hoffman, George W. 48
Holmes Fibre-Graphite Mfg. Co. 29
Holophane Glass Co. 6
Holtzer-Cabot Electric Co. ....
Homer & Co., F. L. 51
Horry, William Smith ....
Houston & Kennelly 55

Huebel & Manger 25
Huebsch & Co., D. A. ....
Hunt Co., C. W. 69
Hunter Machine Co., James 64

Ide & Sons, A. L. 68
Illinois Insulated Wire Co. 72
Incandescent Elec. Light Manipulator Co. ....
India Rubber & G. P. Ins. Co. 72
Insulating Saddle Staple Co. 58
International Correspondence Schools. 52
International Electric Co. 3
Iron Clad Resistance Co. 27

Jandus Electric Co. ....
Jefirey Mfg. Co. 68
Jenkins Bros. 1
Jenney Electric Mfg. Co. 60
Jessop & Sons, William ....
Jewell, E. W. 47
Johns Hopkins University ....
Johns Mfg. Co., H. W. 3
Johnson & Morton 61
Johnston, Thomas J. 55
Jones & Sons Co., J. 27
Jonson & Co. 67

Kammer Co., John 30
Kartavert Mfg. Co. 1
Kelly & Krotz ....
Kendrick & Davis 19
Keuffel & Esser Co. 72
Keystone Electrical Instrument Co. 21
Kinsman, Frank E. 55
Kittredge, Smith & Co. 10
Klein & Son, Mathias 10
Klipstein & Co. 30
Knapp Electric & Novelty Co. 3
Knowles, C. S. 47
Kokomo Telephone & Elec. Mfg. Co. 58
Kosmic Oil Filter Co. 68

Lafayette College 52
LaKon Co., The 25
La Roche & Co., F. A. 1
Lea Mfg. Co. 18
Leather Preserver Mfg. Corp. ....
Leclanche Battery Co. 3
Leffel & Co., James ....29 and 68
Lincoln Electric Co. 61
Link, Henry 10
Lindsley Brothers Company 10
Link Belt Engineering Co. 67
Liverpool & London & Globe Ins. Co. ....
Locke, Fred M. 21
Lombard Water Wheel Gov. Co. 47
Lunkenheimer Co., The 68
Lynn Incandescent Lamp Co. 3

McDermid Mfg. Co. 57
McGowan Co., The John H. 68
McIntire Co., The C. 3
McIntosh Battery & Optical Co. 23
McIntosh, Seymour & Co. 66
McKenzie Furnace Co. 64
McLaren & Goodchild 2
McLennan & Co., K. 48
McRae, A. L. 55
Machado & Roller 21
Mailloux, E. O. 55
Maintenance Co., The 60
Main Belting Co. ....
Manross, F. N. 3
Marshall, William 72
Mason Tele. Pay Station Co., The 56
Massachusetts Chemical Co. 1
Mayer Electric Co., Maxwell M. 61
Meyrowitz, E. B. 22
Mica Insulator Co. 30
Michigan Electric Co. 5
Michigan Pipe Co. 30
Miller Improved Gas Engine Co. ....
Modern Electric & Mfg. Co. 3
Moloney Electric Co. ....
Mona Mfg. Co. 22
Monson-Burmah Slate Co. 72
Montauk Multiphase Cable Co. 13
Moon Mfg. Co. ....
Moore, A. F. 1
Morris Arc Lamp Co. 10
Munsell & Co., Eugene 30

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New Eng.and Motor Co. ....
New Excelsior Dry Battery Co. 13
New York & Ohio Co. 1
New York Central R. R. 6
New York Insulated Wire Co. 1
New York Telephone Co. 51
Non-Polarizing Dry Battery Co. 8
North Electric Co. 56
Northern Electrical Mfg. Co. 29
Northwestern Telephone Mfg. Co. 58

Okonite Co., Ltd., The 1
Onondaga Dynamo Co. ....
Osterberg & Sutton 55
Ostrander & Co., W. R. 30

Pacific Electric Co. 10
Paiste Co., H. T. 25
Pass & Seymour 15
Patent Record Co. 50
Payne Co., Inc. 67
Peerless Rubber Mfg. Co. 30
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Pelton Water Wheel Co. 29
Pepper & Register 55
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Pettingell Andrews Co. 9
Phelan, D. W. 10
Philadelphia Mach. Screw Works. 69
Phillips Insulated Wire Co. 30
Phoenix Battery Mfg. Co. 8
Phoenix Glass Co. 1
Phosphor-Bronze Smelting Co. 68
Pittsburg Glass Co. 50
Pittsburg Transformer Co. 27
Potter Co., F. D. 66
Pratt & Whitney Co. 70
Pratt Institute ....
Preston, Cohen & Co. 10
Priestman & Co. 68
Prindle Pump Co. 48
Pringle, W. T. 50
Proposals ....48 and 52
Purdue University 52

Queen & Co., Inc. 4
Quimby, William E. 69

Raster Carbon Rheostat Co. 2
Rawson Electric Co. 58
Reckenzaun, Fred'k 55
Reid, Thorburn 55
Reisinger, Hugo ....
Reliance Lamp Electric Co. 21
Ridgway Dynamo & Engine Co. 59
Riker Electric Motor Co. 1
Roberts Electric Supply Co., H. C. ....
Roche, William 56
Rockwood Mfg. Co. ....
Roebling Sons' Co., J. A. ....
Rolfe Electric Co. 47
Rosenbaum, W. A. 47
Rossiter, MacGovern & Co. 49
Roth Brothers & Co. 60
Rousseau's Electrical Works, Inc. 2
Royal Electric Co. 23
Rushmore Dynamo Works 3
Ryle & Co., Wm. ....

Sachers, Ralph Julian 47
Salem Iron Works 10
Samson Cordage Works 30
Sargent & Lundy 55
Sawyer-Man Electric Co. ....
Schieren & Co., C. A. 1
Schmidt & Bruckner Electric Co. 56
Schoonmaker, A. O. 2
Schwalm Co., George F. 72
Sebastian Lathe Co. 69
S. E. I. Co. 51
Seneca Falls Mfg. Co. 69
Sheaff & Jaastad 55
Shapiro & Aronson 57
Shultz Belting Co. 1
Siemens & Halske Electric Co. 62
Simplex Electrical Co. ....1 and 19
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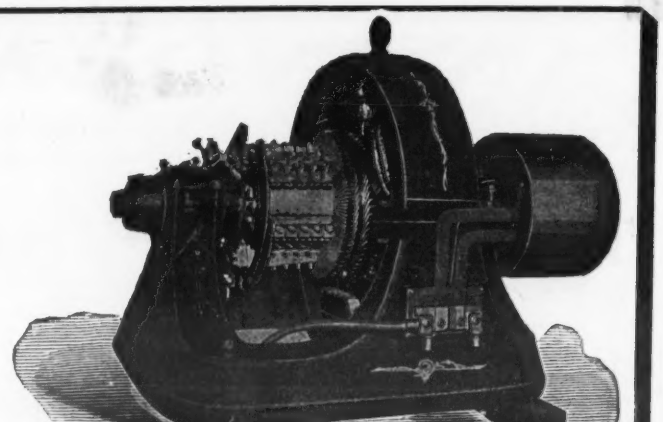

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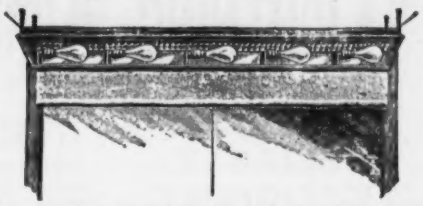

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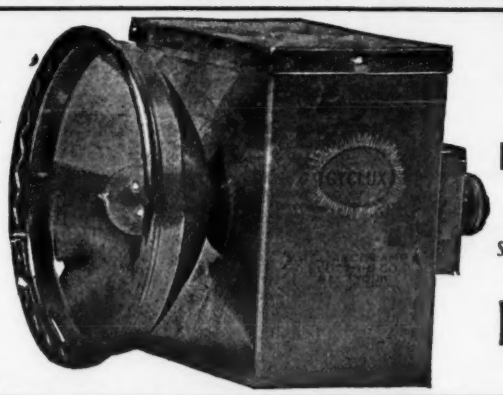

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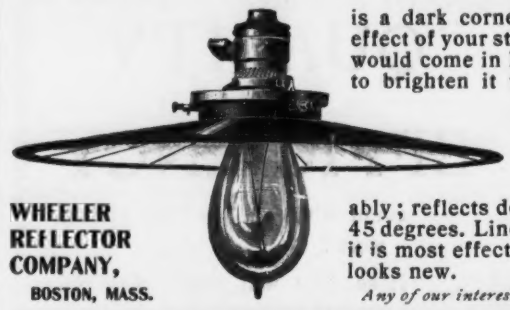

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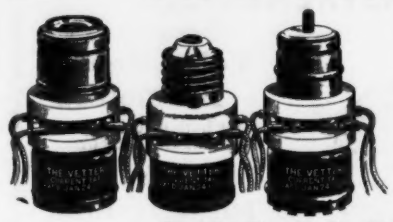

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ALPHABETICAL INDEX TO ADVERTISERS.—*Continued from Page 20.*

Smith, A. T. .....
Smith Co., S. Morgan 28
Smith Interchangeable Tele. Co. 56
Spencer Electrical Co. 57
Sperry, B. N. 2
Splitdorf, C. F. 3
Sprague Electric Co. 61
Standard Electric Time Co. .....
Standard Paint Co. .....
Standard Telephone & Electric Co.....58
Standard Thermometer and Electric Co..15
Standard Underground Cable Co. 72
Stanley & Patterson 1
Sterling & Son, W. C. 10
Sterling Electric Co. 57
Sterling Varnish Co. 30
Steward Mfg. Co., D. M. 7
Stewart & Co., F. H. 10
Stewart Electrical Co. .....
Stilwell-Bierce & Smith-Vaile Co.....29
Stirling Company, The 66
Stone City Telephone Co. .....
Storage Battery Supply Co. 6
Storey Motor & Tool Co. 2
Stow Mfg. Co. 67
Stromberg-Carlson Tele. Mfg. Co.....57
Sturtevant Co., The B. F. 60
Stucky & Heck 61
Telephone Mfg. Co. 58
Thomas & Sons Co., R. 7
Thompson, Guion 55
Thompson, Edward P. .....
Thompson, Son & Co. 50
Toomey, Frank 51
Townsend & Decker 47
Triumph Electric Co. 20
Union Boiler Tube Cleaner Co. 1
Union Hardware Co. 21
Union Porcelain Works 13
United Correspondence Schools 47
United Electric Improvement Co.....
United Electric Heating Co. 27
United States Carbon Co., The.....1
University of Notre Dame 52
Utica Fire Alarm Telegraph Co.....57
Valentine-Clark Co. 10
Van Dorn & Dutton Co. 51
Varley Duplex Magnet Co. 3
Varney & McOuat 51
Viaduct Electric Co. 57
Victor Electric Co. 61
Vitro-Chrome Chemical Co. .....
Vose, Ralph .....
Vulcanized Fibre Co. 47
Wagner Electric Mfg. Co. 9
Walsh's Sons & Co. 50
Want and For Sale Ads.....48 and 52
Ward Leonard Electric Co. 17
Warren Elec. Mfg. Co. 62
Warren-Medbury Co. 60
Watkins, F. M. 67
Watson-Stillman Co. 66
Webster Chemical Co. 25
Western Electrical Supply Co. .....
Western Electric Co. 5
Westinghouse, Church, Kerr & Co.....
Westinghouse Electric & Mfg. Co.....71
Westinghouse Machine Co. .....
Weston Electrical Instrument Co. 72
Wheeler Reflector Co. 22
White & Co., J. G. 55
White Co., The O. C. .....
Whitney Electrical Inst. Co. 21
Williamsport Wooden Pipe Co. 7
Willyoung, Elmer G. .....
Wirt Co., Charles 72
Woodward Governor Co. .....
Worstall & Co., A. M. 55
Worthington, Henry R. 2
Wrought Iron Bridge Co. 69
Wyckoff Creosoting Co. 30
Young Mfg. Co., W. C. 69
Youngstown Bridge Co. 64
Ziegler Electric Co. 4
Zimdars & Hunt .....

A very interesting full page announcement will appear in this border next week.

Watch for it, and, when you see it, don't fail to read the announcement.